Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

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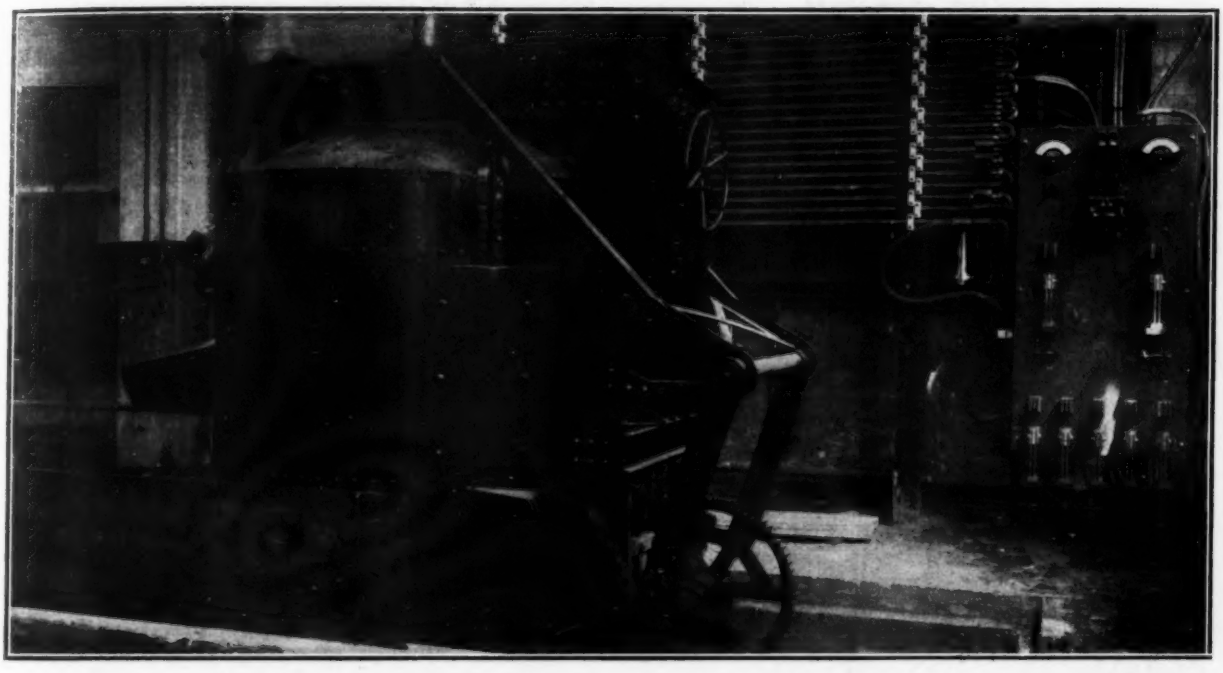


Single-Phase Doorless Furnace at New London Ship & Engine Company's Plant.

A Study of Electric-Furnace Operation

Relation of the Costs of Electrodes, Refractories, Electricity, Labor and Raw Materials to Total Expense, with Special Reference to Single-Electrode Furnaces

By F. T. SNYDER

THE industrial electric furnace, having now become an established commercial fact with a rapidly growing place in the metallurgical industries, it becomes of interest to consider what has been developed technically and the directions in which future development is tending.

A good way to get at the matter is to take the case of an ideal electric furnace working at 100 per cent efficiency and consider how items of construction, affected by the current supply, reduce this perfect efficiency. To visualize this effort, consider the case of an electric steel furnace melting steel scrap at the rate of 1000 tons a month and pouring the molten metal into a ladle.

The financial man responsible for the operation of an electric steel furnace finds that there are six items of expense:

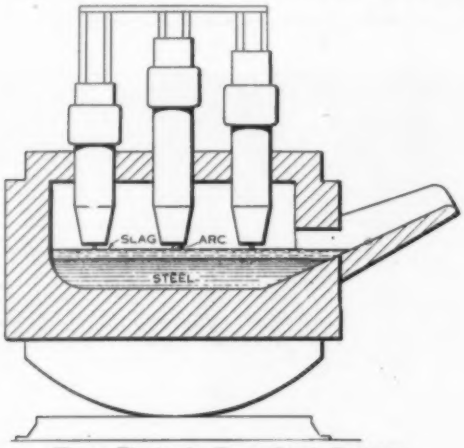
(1.) The cost of electrodes.
(2.) The cost of refractories.
(3.) The cost of electricity.
(4.) The cost of labor.
(5.) The charges for maintenance, depreciation and interest on the original investment.
(6.) The cost of raw materials.

This last item of raw materials is practically unaffected by the type of furnace construction, or the form of current supply, as long as the furnace is reasonably well operated, and can therefore be left out of further consideration.

THE COST OF ELECTRODES.

Each electrode in a furnace costs the user in two ways. The electrode gradually burns up and involves a cost per pound of electrode. The electrode also conducts heat out of the furnace. This heat has to be paid for at a kilowatt-hour rate. The sum of these two items constitute a charge per hour of furnace operation, and if the furnace is operated at a constant

rate they constitute a charge per ton of product. For a well designed furnace melting a thousand tons of steel a month, these items constitute a charge of some $6,000 a year *per electrode*. It is quite evident that reducing the number of electrodes is something that warrants serious consideration. With capital worth 20 per cent a year, the elimination of one electrode on such a furnace would justify an investment of $30,000.



Three-Electrode Type Steel Furnace.

The ideal furnace would have no electrodes. The induction furnace met this requirement, but unfortunately the induction furnace had inherently two defects. One was electrical. To act as a short-circuited transformer secondary, the furnace had to be built in the form of an open ring. This greatly increased the radiation surface. The other defect was metallurgical. The energy was developed in the metal and the metal was therefore hotter than the slag. This reduced the speed of the chemical reaction by which the impurities of the steel were transferred from the metal to the slag. Together these two defects so reduced the speed and increased the cost of melting per ton of steel that the operating cost of an induction furnace became commercially prohibitive, as compared with arc furnaces of all types. In addition, the electrical limitation of the furnace design caused by combining the transformer with the furnace forced the use of low frequency, 5 to 10 cycles, which in turn required special substation equipment and resulted in an investment per ton of product more than double that required for arc furnaces.

As the use of no electrodes has proven to be commercially impractical, the minimum number that may be used is one. By using the metal bath in the furnace as one terminal of the arc, a furnace can be operated with one electrode per arc, one side of the circuit being connected to the electrode, the other side to the molten metal bath. Such a contact between the electric circuit and the bath is permanent and has a heat-loss cost below one-tenth of that of the operating cost of using a second electrode. If one electrode with one arc and a contact or two electrodes with two arcs in series are used, it is evident that the current supply must be single phase or direct current.

As three-quarters of the large total cost per year of each electrode is due to surface burning, it is evident that the smaller the surface, that is, the smaller the electrode, the lower will be the electrode cost. The size of the electrode is determined by the number of amperes of current which it has to carry. The power input into the furnace is the product of amperes and volts. The amperes of current, and, therefore, the size and surface of the electrode, will be smaller, the higher the voltage between electrode and metal bath. This voltage is limited by a roof condition. Silica brick, which are universally used for steel-furnace roofs, are fairly good conductors of electricity at white heat. At steel finishing temperatures, the gases in the furnace are also rather good conductors. When the potential is switched on the arc will jump a considerable distance. In regular furnace practice this limits the voltage between a single electrode and the bath to about 220 volts. If two or more electrodes are used through the same roof, practical experience has developed a limit of about 110 volts between electrodes to avoid breakdown roof leakages. For two electrodes this is 55 volts between each electrode and the bath. With the same energy input to the furnace each of the two electrodes therefore has to have double the cross section of the single electrode with the higher voltage, or their combined cross section is four times the section of the single electrode. Their heat loss is therefore four times that of the equivalent single electrode and three times the sum of the heat losses of the single electrode and a contact to the bath. The surface of the two electrodes exposed to burning is double that of the single electrode. The equivalent cost of the two electrodes with two acrs in series, on the basis of 1000 tons of steel a month, is therefore $13,500 a year as compared with $7500 a year for the one electrode and its contact.

If three electrodes are used through the same roof, so as to introduce directly three-phase current into the furnace, the limiting potential between electrodes is in usual practice kept at about 110 volts. Due to the phase relations of the currents in the three electrodes this results in a potentiol between each electrode and the bath of about 65 volts. With the same total input each electrode of the three will carry one-third the energy carried by a single electrode, at about one-third the voltage. Therefore, *each* electrode of the three will carry the same current as does the single electrode and consequently will each be the same size, with a total of heat losses and surface burning equal to three times those of the single electrode. For 1000 tons of steel per month the electrode cost for the three electrodes will be $18,000 a year as compared with a yearly cost of $7500 for the single electrode and its contact.

The Cost of Refractories.

In a well operated electric steel furnace the bottom and side walls are substantially permanent. The tendency of the bottom is to build up rather than wear away. It is the common knowledge of electric steel operation that the bulk of the refractory cost is due to roof wear and that the roof wears most around each electrode. In other words—the roof wear is substantially proportional to the number of electrodes. The combination of these facts may well be taken in corroboration of the cost figures from different furnaces showing a total refractory cost for three-electrode furnaces of substantially three times the total refractory costs for single-electrode furnaces. With a well designed furnace melting 1000 tons of steel a month, this refractory cost may be kept down to $4000 per electrode per year.

A further factor in the cost per ton of refractories is the fact that it is the maximum temperature at the end of the heat that wears the refractories in a steel furnace. As the roof walls and slag are near the same temperature, the arc radiates to each about the same. Part of this energy is absorbed by and passes through the rof and wall. In a well designed furnace this

amounts to less than 10 per cent of the total power input and consequently does not materially affect the wall temperature conditions. Of the energy radiated by an arc about one-half goes directly to the slag; the other half is reflected by the roof and walls. The roof and walls are therefore at a temperature between the temperatures of the slag and the arc.

In a steel furnace the temperature of an arc is not determined by boiling point of the carbon electrode, as gases from the metal and slag materials are always available to carry the arc. In a steel furnace the arc temperature is determined by the temperature the arc has to back up in order to radiate the amount of energy developed in the arc. The energy to be radiated per square inch of arc surface determines the temperature to which the arc must rise to get rid of energy at the input rate. If the arc is twice as long and remains the same diameter it will have twice the surface and radiate twice the energy at the same temperature, or will radiate the same amount of energy at a lower temperature. The current in *each* electrode of a three-electrode furnace is the same as the current in the single electrode of a one-electrode furnace. The diameter of each arc is therefore the same. The three-electrode arc voltage is 65. The single-electrode arc voltage is 220. In each case about 35 volts are absorbed by the arc terminals. This leaves 30 volts per arc to determine the length of each of the three arcs of the three-electrode furnace and 185 volts for the single arc of a one-electrode furnace. Therefore, the total length of the single arc is more than twice the sum of the lengths of the three arcs. As this single arc has consequently to radiate only half the energy per square inch, it will be cooler than each of the three arcs, as it does not have to back up so far to radiate its energy. As the arc is cooler, so will the walls from which its heat is reflected be cooler also. While this cooler temperature of the long, high-voltage arc does not amount to a great many degrees, the reduction in temperature comes near the melting point of the silica brick of the roof and makes a large actual increase in the number of heats that the roof will last.

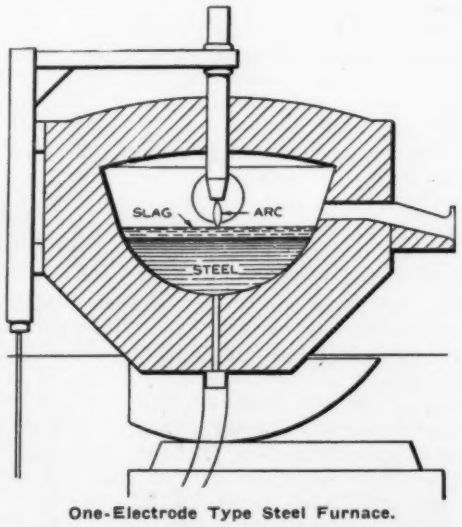
The Cost of Electricity.

In melting steel a certain definite amount of energy is contained in the melted metal as it is poured into the ladle. This energy may be measured and may be expressed in kilowatt-hours. A second definite amount is contained in the hot slag that accompanies each ton of metal, and a third amount leaves the furnace in the gases that are given off during the melting of each ton. The sum of these three items approximates 350 kilowatt-hours per 2000 pounds of steel. It is the object of an electric furnace to put these necessary three heat items into the furnace with as little loss or additional cost as possible.

In addition to these necessary heat items there are others that are direct losses. One is the radiation through the furnace shell, the second is the heat loss through the electrodes. After the furnace is heated up these losses go on all the time whether the current is on or interrupted. In a furnace designed to produce 1000 tons of steel a month these losses would be about 120 kilowatts continuously. If this furnace were given an energy input of 240 kilowatts, after the heat losses were provided for only 120 kilowatts would be available for melting steel, at which rate it would take about three hours per ton melted. During this time 3×120 kilowatts or 360 kilowatt-hours of heat energy would be lost, making a total energy consumption of 350 kilowatt-hours plus 360 kilowatt-hours or 710 kilowatt-hours per ton of steel. If, on the other hand, this same furnace be given an energy input of 820 kilowatts, the net energy available for melting after the losses were supplied would be 700 kilowatts, which would melt the same ton of steel in a half hour. During this half hour the heat losses would only be 60 kilowatt-hours, so that the total energy to melt would be 410 kilowatt-hours per ton of steel. It is therefore apparent that the higher the input into a furnace the higher the heat efficiency. With a three-electrode furnace the limit is soon reached, as the electrodes become so large that there is not room enough on the roof to space the electrodes far enough apart to prevent current leakage through the roof. The electrical insulating qualities of the roof bricks can be increased by cooling them with water jackets. The heat loss to such water jackets, however, is much greater than the heat saved by the increased energy input or voltage rise made possible by the use of the jackets.

It is a common but mistaken idea that increasing the rate of energy input into a furnace makes the furnace necessarily operate at a higher temperature inside. Actually, the temperature in a furnace is determined by the melting point of the material in the furnace and is practically uninfluenced by the rate of energy input, as long as there is material to melt, provided there is at least enough energy input to take care of the radiation and other heat losses. This can be simply demonstrated by attempting to boil water containing ice. As long as there is unmelted ice in the water the temperature will not rise above the melting point of the ice. The energy is absorbed in changing the state of the ice instead of in raising its temperature. In the same way, as long as there is unmelted steel in a furnace, the furnace temperature cannot get above the melting point of steel, no matter at what rate energy is put into the furnace through the electrode.

With a single-electrode furnace no limit has yet been found to the rate at which power can be put into a furnace and the efficiency correspondingly raised, if certain simple metallurgical precautions are taken. To make merchantable steel the raw scrap not only has to



One-Electrode Type Steel Furnace.

be melted, but it has to be freed of the oxygen which it held as iron rust. Getting this oxygen out is a chemical matter that requires time. The steel cannot be poured until it is substantilly freed of oxygen—"killed" as the steel melter phrases it—for then the steel lies quiet and does not bubble and throw off sparks. If energy is put into the furnace faster than the steel can be killed, after the steel is melted, the

excess only operates to raise the temperature and melt down the furnace walls, soon destroying the furnace structure.

To permit a high rate of energy input something must be done to speed up the rate at which oxygen can be eliminated from the metal. The best way to do this is to prevent a supply of air from reaching the

Doorless Furnace With Tilting Roof at Chicago Bearing Metal Company's Plant.

inside of the furnace. As long as the air leaks in around furnace doors, getting the oxygen out of the steel is a slow process and effectively prevents a high and efficient power input. In addition, each door represents a direct energy loss. The air goes in at the bottom of the door, gets heated, burns up some of the electrodes, oxidizes some of the steel and then comes out, carrying the heat it has acquired. Direct measurement has shown that the heat loss alone amounts to some $1500 a year for each door of the usual sliding type. But the more important commercial loss is that the presence of the oxygen of this air in the furnace greatly slows down the speed at which the oxygen can be taken out of the steel. Two ordinary doors on an electric steel furnace may easily double the time required to "finish" a heat. In other words—the furnace only produces half the tonnage of steel. As the same labor, electrodes, refractories and heat losses have to be carried by this half tonnage these cost items are doubled per ton.

As soon as this condition was realized efforts were made to secure better fitting doors, but it is difficult to make such doors tight. The high heat in the furnace and in the escaping gases soon destroys any metallic joints. Plastic refractories, such as fire clay, shrink as they dry and soon drop out of a vertical joint. It is a practical impossibility to get furnace men to keep constantly renewing such jointing. The difficulty was entirely and simply overcome by eliminating the doors altogether. To get the charge into a doorless furnace the furnace roof was arranged to tilt up. A simple, permanent and self-sealing joint was made by putting a narrow ring of sand on the top of the furnace wall. When the roof closed on this no renewals or patching was neecssary. This method of charging the furnace has the additional advantage that any piece of scrap the furnace will hold can be put in through the open roof, while with doors the scrap has to be cut up enough to go through the door. A number of furnaces without doors and with lifting roofs have been running for two years and it has been found that the heat loss in opening up the roof is much less than the heat lost through a single door. As the absence of doors thoroughly protects the steel from oxidation from air, heats of steel can be deoxidized as they are melted; that is, as soon as the steel is melted it can be poured. With these doorless furnaces no limit has yet been found to the rate at which they may be run. Steel heats from cold metal in one hour have proved entirely practical.

The Cost of Labor.

With an open-roof furnace the charging can be readily done with a bottom-dump bucket on a crane. Consequently, any sized doorless furnace can be operated by one melter with one helper. On furnaces outputting less than 500 tons a month no helper is needed. Such an ideal labor situation is the attribute of a single-electrode furnace. By having a single electrode a high voltage is possible. This means a small current and a small, light-weight electrode. Such a small electrode can be operated readily by a simple handwheel. There being only one to adjust little of the melter's time is required. High voltage also saves electrode labor in another way. The 30 volts available for arc length in a 65-volt three-electrode arc gives a length of about ¾-inch. The usual slag bubble rises about this distance, so each time a bubble comes up under an electrode the power load is short-circuited at the arc. With a single-electrode arc about 185 volts are available for arc length, which gives an arc about 5 inches long. The rising of a bubble ¾-inch under such a single electrode consequently reduces the arc resistance less than 20 per cent. For this reason the boiling of the bath is something that does not take any of the melter's time in a single-electrode furnace and does take all the time of one man in a three-electrode furnace. To overcome this item three-electrode furnaces are frequently supplied with three automatic regulators and motors. In actual practice such automatic regulators have proven to be a complicated and delicate auxiliary for use under the difficult conditions in a steel plant and have yet to demonstrate their value as labor savers. A third labor item connected with electrodes is the fact that the three-electrode furnace burns up three times as many pounds of electrode as the single-electrode furnace. A furnace with doors burns up four times as much electrode as a doorless furnace, so a doorless, single-electrode furnace only uses 1/12 as many pounds of electrode per ton of product as a three-electrode door-type furnace. The handling and replacing of this great excess weight of electrode makes a substantial labor item. Furnace roofs last so much longer with a single-electrode hole through them than with holes for three electrodes that the labor item of making up and putting on roofs is greatly reduced with the one electrode. As the sum of these savings, some $4000 per year will be saved in labor cost in the production of 1000 tons of steel a month in a single-electrode, doorless furnace.

The Charges for Maintenance, Depreciation and Interest.

As the three-electrode equipment is obviously three times as complicated as a single-electrode equipment, especially if automatic regulators are used, it is quite clear that the maintenance and depreciation items are

to be much higher with three electrodes than with a single-electrode furnace. As the single-electrode furnace can be readily and satisfactorily operated at double the speed of the three-electrode furnace, it is equally evident that the orginal investment and therefore the interest on first cost is going to be substantially lower with the single-electrode equipment. With a furnace outputting 1000 tons of steel a month the difference due to these items will reach $6000 a year.

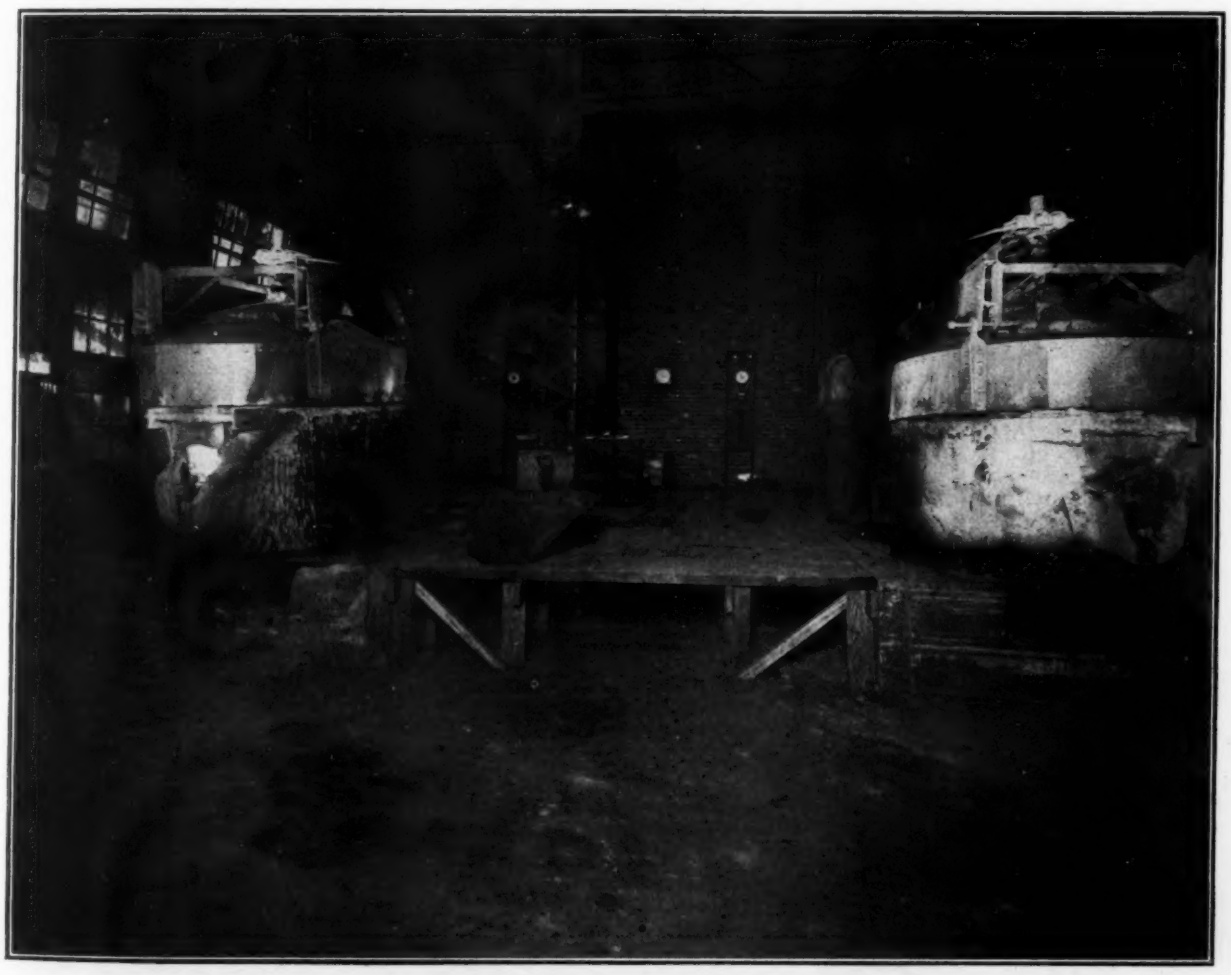
Summing the matter up a financier responsible for an electrical steel furnace investment to produce 1000 tons of steel a month faces these conditions. If he installs a single-electrode furnace without doors in place of a three-electrode, door furnace, the saving will be

1—Due to electrodes	$11,500.0
2—Due to refractories	8,000.00
3—Due to electricity	7,000.00
4—Due to labor	4,000.00
5—Due to charges	6,000.00
A total of	$36,500.00

As a well designed furnace requires an energy input of about 800 kilowatts to output 1000 tons of steel per month, this saving equals $45 per year per kilowatt. It requires no argument to prove that this is a good return on the investment required to change the standard three-phase alternating current used in distribution systems into either single-phase or direct current suitable to use in a one-electrode furnace.

Although the industrial electric furnace has a commercial history going back some tweny years, its important applications and growth are matters of the last few years only. Only recently have enough furnaces of different types been in operation under sufficiently diversified conditions to determine the effects of different constructions. From the electric point of view the conflict of types of furnaces has been curiously like the situation through which the electric railway motor passed. Both railway motor and furnace are confronted by the established commercial fact that electric power can be generated and transmitted more cheaply as three-phase alternating current than in any other form. For both railway motor and furnace there are reasons, individual to each, why some other form of electric current can be utilized with higher efficiency and reliability than the use of the polyphase alternating current directly in the railway motor or furnace.

As the first introduction of the railway motor antelated the present method of three-phase generation and transmission, the apparent simplicity of feeding a three-phase motor direct from a three-phase system had to meet a well intrenched competitor, but even with this handicap the three-phase railway motor was for some time given serious consideration, especially in Europe. The electric furnace coming after the methods of three-phase generation and distribution were well established naturally entered at the point of least commercial resistance and undertook at first to use the three-phase current directly in the furnace. Gradually, as an electric furnace engineering grew up, it was realized that as with the railway motor, so with the furnace, the direct use of three-phase alternating current resulted in low efficiencies, and high costs per unit of result.



An Installation of Single-Phase Doorless Furnaces.

Electric Furnace Making Big Headway in the Steel Industry

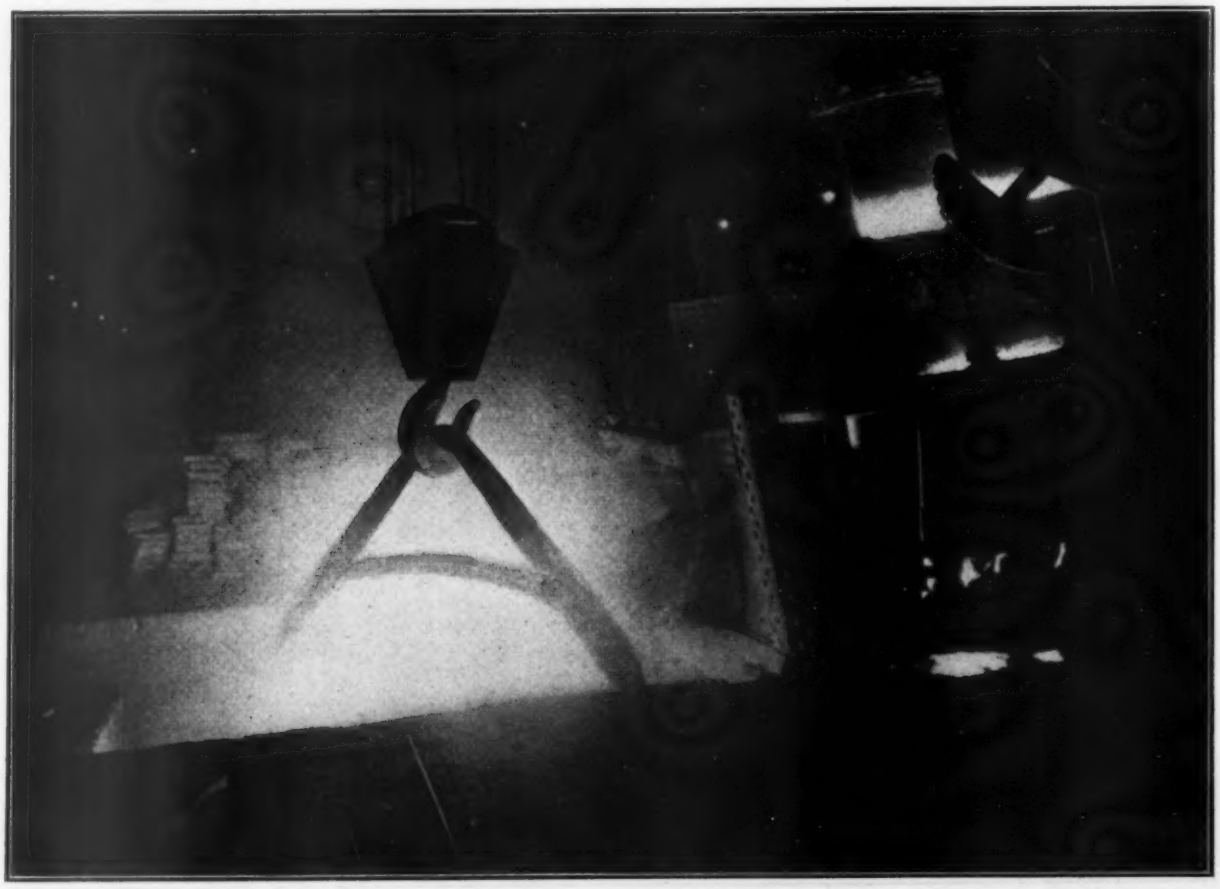
War's Heavy Demand for High-Grade Steels Increasingly Met by Electric-Furnace Products—Advantages of Electric Smelting, Refining of Steel, Production of Alloy Steel sand Steel Castings

DIRECTLY and indirectly the big war has given great impetus to use of electric furnaces in the steel industry. Prior to the war the use of these furnaces in that industry was rather restricted and very much less than in the aluminum, calcium-carbide and artificial-abrassive industries. To adapt electric furnaces to steel making, refining and melting required considerable experimental and general development work, the incentive for which was lacking due chiefly to the conservatism of steel makers, their satisfaction with the methods long in use and unwillingness in view of fluctuating market conditions to expend the necessary funds for research work and trial installations.

War Gives Stimulus to Electric Steel Furnace.

The present war has been record-breaking in many features, one important one being its extraordinary demand for metals. The first result of this was to send metal prices skyward. The heavy demands upon them with every prospect of long continuance, combined with the remunerative prices obtained, caused the metal producers and refiners, especially the steel makers, to look with more favor upon experimental work to improve their products. Certain purchasers of steel, notably in the automobile industry, also manifested a desire for greater use of high-grade steels for axles, bearings, gears, steering rods, etc. The heavy demand for metals also directed attention to better utilization of scrap metals, particularly of steel parts of wornout machinery, steel turnings, old rails, etc. The outcome of all this was to stimulate greater development of the electric furnace for the steel industry.

This was greatly accelerated when munition manufacture was undertaken on a large scale. The production of shells, ordnance, small arms, military motor trucks and tractors, submarines, torpedo boats and other naval craft, called for large quantities of special alloy and other high-grade steels and the need for speedy production necessitated use of intensive shop methods with a greatly increased demand for high-



Pouring Refined Steel From a Six-Ton Arc Furnace.

speed tool steels. This was still further intensified by the growing scarcity of labor.

The foregoing conditions existed not only in this country, but also in practically every industrial country in the world, neutral as well as belligerent. Abroad, however, other factors influenced the development, especially in Europe. Space does not permit going into these. It will suffice to show most emphatically the rapid and world-wide extension of the use of the electric steel furnace during recent years by reproducing part of a table compiled by the Society for Electrical Development.

ELECTRIC STEEL FURNACES IN VARIOUS COUNTRIES OF THE WORLD.

Countries.	March, 1910.	July 1, 1913.	Jan. 1, 1915.	Jan. 1, 1916.	Jan. 1, 1917.
Germany and Luxemburg	10	10	18	18	18
Austria-Hungary	2	2	3	4	4
Switzerland	12	20	22	22	29
Italy	23	13	17	21	29
France	7	16	16	46	88
Great Britain	3	3	3	3	3
Belgium	2	4	9	11	16
Russia	5	6	18	23	40
Sweden	..	3	2	6	9
Norway	..	1	1	2	2
Spain	..	1	1	1	2
Japan	..	1	1	1	1
Mexico	3	4	1	1	1
Australia	..	..	1	1	..
Chile	..	..	..	1	1
Roumania	..	..	..	..	21
Location not given	..	..	12	9	
Total outside the United States and Canada	101	118	170	222	316
United States	10	19	41	73	136
Canada	3	3	2	8	19
Total in United States and Canada	13	22	43	81	155
Grand total in the world	114	140	213	303	471

This table gives the number of electric furnaces in operation in the steel industry on the dates given, except that the figures given for January 1, 1917, include both furnaces operating and contracted for. Outside of Belgium and Mexico, both countries sapped respectively by invasion and civil war, we find all other countries listed making big strides in the use of electric steel furnaces since the war began, this being especially true of Great Britain, Sweden, Russia, Norway, Canada and, last and most important of all, the United States. Great Britain now has over five times as many furnaces as prior to the war, Russia four times as many, Sweden over six times as many, Norway three times, Canada over six times, and the United States over seven times. Since the first of the year numerous other electric furnaces have been contracted for in this country, so that the lead which we established at the beginning of 1916 is being well maintained. We now have considerably over one-fourth of the electric steel furnaces in use throughout the world and for nearly two years have been the leading electric steel producer.

Before dropping this phase of the subject it may be well to point out that in the United States, in Great Britain and in Sweden, the number of electric steel furnaces reported was nearly doubled during the year 1916; in Canada it was more than doubled last year. These countries are likely to show still further development of the electric steel industry during this and following years. The extraordinary increase last year, while stimulated chiefly by the war, is in all likelihood a permanent advance of this new industry because of the rapid recognition of the superior properties of electric steel, of which more will be said further on.

ELECTRIC STEEL OUTPUT.

A few words may also be given as to outputs. In 1908 it is reported that 55 tons of electric steel were produced in the United States; in 1916 this output was about 175,000 tons. In the city of Sheffield, the great steel center of England, electric steel is now being produced at the rate of about 100,000 tons per year. In Germany it is said that some 225,000 tons of electric steel were turned out in 1916. Dr. Mathews, in a paper recently presented before the American Electrochemical Society, said that in the United States there is no less than 150,000 kilovolt-amperes represented in the electric steel furnaces in operation or just being installed. The annual tonnage capacity of these furnaces he estimates to be about 1,250,000 gross tons of ingots and castings. It is impossible to figure this exactly, because some furnaces may operate on either refining or cold melting charges, and, of course, the output is much greater when the former method is used. This infant industry already represents an output about eight times as great as the crucible-steel production and one-eighth that of Bessemer production. These two processes are not declining but are more or less stationary, with wide annual fluctuations. The Society for Electrical Development, in a recent publication, estimates the world's output of electric steel as well over 2,000,000 tons per annum at the present rate of production.

Two specially noteworthy furnace installations now being made are at Toronto, Canada, and Chicago, Ill. The former consists of ten furnaces being constructed for the Canadian Government for producing steel for shells. Each will have a capacity of six tons and will be used for melting cold charges. At the South Chicago works of the Illinois Steel Company, there is to be installed what will be the largest electric steel plant in the world. It will consist of 10 electric furnaces of 30 tons capacity each. They will be fed hot charges in a triple process. The steel will be made first in Bessemer converters that will supply two 250-ton open-hearth furnaces; these will serve largely as reservoirs of the fluid partly finished steel and will in turn feed the electric furnaces where the final refining will be done. The capacity of this single plant will be about 50,000 tons per month and it will be used for making high-grade steel for rails and other products and special steels.

EVIDENCES OF PERMANENT PROGRESS AND EXCELLENCE OF FUTURE PROSPECTS.

The significance of these two huge installations is that both for munitions of war and for standard products of peace it is recognized that electric steel possesses properties of such marked superiority that in the one case a government and in the other a branch of the world's largest steel corporation are ready to invest hundreds of thousands of dollars for electric furnace plants. It stands to reason that these investments were not made without the most careful preliminary investigation. They show conclusively the confidence that may be given to further permanent progress in the electric steel industry.

No one knows how long the world war will last, but it is certain that during its continuance it will call for huge quantities of high-grade steels. In fact, it is not far-fetched to say that successful termination of the war and hastening of its end will be insured by

liberal and speedy supply of such steels, which means more and more the products of the electric furnace. This is shown by the very rapid increase during the last 18 months, as already cited, of the electric steel output of England and Canada, whose prime business is war.

The United States has but entered into the war. Our government has already planned and largely also contracted prodigious expenditures for war purposes, notably for naval vessels, heavy ordnance, shells, small arms, airplanes, motor trucks, etc., for the production of which there will be needed vast quantities of the highest grades of steel, special alloy steel and high-speed tool steel. For instance, for automobiles and airplanes there are needed many parts of greatest possible strength combined with lightness, because upon the reliability of the vital parts depends the safety of the operator as well as the effectiveness of these most useful weapons of war. This calls for the best grade of steel castings and forgings and experience in the well established automobile industry already shows that electric steel is the best material for this purpose. The demand for speed in the execution of government contracts at a time when mechanics and artisans in general are scarce necessitates the most intensive shop methods and therefore the greatly increased use of high-speed alloy-steel tools, whose already general use in machine shops has brought about marked speeding up and economy of production. This means further call for electric steel, which is peculiarly adapted for the economical production of the relatively expensive high-speed tool steels, which are chiefly special alloy steels containing tungsten, vanadium, molybdenum and other rather costly metals.

Regardless of the length of the war, the war requirements for electric steel will permit still greater development of the electric steel industry and therefore put it on a surer foundation to withstand the keener competition on a cost basis that is likely to come after the war. The prediction has been freely made, however, by many metal experts that the extraordinary demands for metals which have filled the order books for many months ahead, especially of the iron and steel, copper and zinc producers, will mean a continuance of fairly high metal prices for some time after close of the war and this will allow a more gradual adjustment to the new conditions. This also will work to the surer establishment of the electric steel industry and permit the merits of this superior steel to be more generally recognized.

Even before the war and coincident with its inception, the automobile industry was calling for large quantities of electric steel, the greater strength, uniformity and reliability of which were seen to be especially suited to making stronger, lighter and better cars. Indeed, according to *The Electrician*, of London, "without such products as high-speed steel, chrome-vanadium steel, aluminum, magnesium and the artificial abrasives, carborundum and alundum—all products of the electric furnace—the modern gasoline car would never have been evolved. Were we to eliminate the electric furnace products and substitute steel and other materials that were used 30 years ago, the cars would be far too heavy for the engine to drive." This shows that the electric furnace is a requisite to the automobile industry and even more so to the growing airplane industry, at least as far as airplane engines are concerned. Mention has already been made that the large South Chicago electric steel plant will produce steel for rails. There has, in fact, been considerable use already of special alloy steels for crossings, frogs, switches and similar special trackwork, and it is reasonable to suppose that important trunk-line railroads will have large demands for the strong and homogeneous electric steel for trackage for the heavy, high-speed passenger and freight trains which impose such hard service on the rails and for which even heavy expenditures are warranted for safety alone.

These facts have been mentioned merely to show that the normal peace requirements for electric steel are already very heavy and steadily increasing. The references made in the foregoing are only to the more pronounced uses of electric steel. It has been and is more and more used for a multitude of purposes, such as for steel castings, forgings, etc. All this goes to show that the prospects for greater use of electric steel products after the war are very bright indeed, especially because the special impetus given to this industry by the war itself is making the electric steel furnace better and more widely understood as well as more generally employed, and its products are now given the opportunity to show their advantages.

Electric Steel Processes.

Before taking up a short discussion of the advantages of the electric furnace in this industry, it is well to describe briefly the principal processes for which it is used.

The processes for which the electric furnace is used in the steel industry may be classified under three principal heads, each of which is more or less subdivided. These principal processes are (1) Smelting direct from the iron ore and producing either pig iron or finished steel; (2) steel making or refining, starting with either pig iron, iron or steel scrap, molten steel or a combination of these, a subclassification under this head being the making of special alloy steels and so-called ferro-alloys; (3) steel melting (for castings) and special heat treatment of steels. This is a rough grouping that will serve the purpose of the general reader, even though it may not satisfy the technical metallurgist.

Smelting direct from the ore and producing finished steel in a single operation is an ideal process, but as far as known has been carried out in but one commercial plant, that formerly operated at Heroult, Cal. In the absence of coke it was supplied with charcoal for the necessary carbon, the charcoal being prepared on the ground. In Sweden there is considerable electric smelting of iron ores, 17 electric furnaces having produced about 100,000 tons of pig iron last year. Electric smelting finds favor chiefly where fuel is scarce and water power abundant. In comparison with the blast furnace for making pig iron, electric furnace smelting is of course much more expensive; it yields a higher quality of iron, however, one especially free from sulphur.

The second class of electric steel processes may be subdivided into steel making and steel refining. The former takes either cold pig iron or iron scrap, or the molten product direct from the blast furnace; the latter takes cold steel scrap or billets, or molten steel more or less prepared in a Bessemer converter or open-hearth furnace. In either case refining takes place, whether or not accompanied by decarbonization, and alloys, such as manganese chromium, vanadium, nickel, tungsten, aluminum, molybdenum, and the like may be added to produce very hard, tough, or other special steels. The furnaces used may have either a so-called acid or basic lining, the former consisting chiefly of silica bricks, while the latter is made of magnesite, dolomite, chrome or magnesia bricks. The basic process is more commonly used on account of greater

Single-Phase Arc Furnace in Operation in Casting Plant. Man at Right Controls Tilting.

economy and producing a product more free of sulphur and phosphorus, which are deleterious elements in steel. Electric steel making is especially superior in the more complete removal of these elements, as well as in the more thorough deoxidation of the steel.

A branch of electric steel making, which is practically a special process, is the production of ferro-alloys, such as ferro-manganese, ferro-chrome, ferro-vanadium, etc. These contain large percentages of these relatively expensive alloying metals and are made separately for use as additions in the final stage of the making of special steels. In the former methods of making these alloys much of the material was lost by oxidation. This is very largely avoided in the electric furnace method on account of its neutral atmosphere and much more perfect heat control. Thus material economy in these very useful but rather costly metals is obtained.

In what is classed above as the third class of electric steel processes, namely, melting and heat treatment, the steel is either molten or merely heated to a definite temperature without melting, in each case under the most favorable circumstances of definite temperature control and freedom from oxidizing or contaminating atmospheres. In melting for steel castings there is frequently also more or less refining of the steel.

Advantages of the Electric Furnace Processes.

There are some 18 makes of electric furnaces used in the iron and steel industry, among which are such well known types as the Heroult, Rennerfelt, Snyder, Girod, Grönwall-Dixon, Stassano, Greene-Etchelles, and Induction. The primary characteristics of these furnaces, from which their many advantages are derived, are the following, which were first pointed out by Sir William Siemens nearly 40 years ago.

First—The degree of temperature is theoretically unlimited.

Second—The fusion is effected in a perfectly neutral atmosphere.

Third—The operation can be carried on in a laboratory without much preparation, and under the eye of the operator.

Fourth—The limit of heat practically attainable with the use of ordinary refractory material is very high because in the electric furnace the fusing material is at a higher temperature than the crucible, whereas in ordinary fusion the temperature of the crucible exceeds that of the material fused within it.

In short, he says that the function of electric melting is to "effect such reactions and decompositions as require for their accomplishment an intense degree of heat, coupled with freedom from such disturbing influences as are inseparable from a furnace worked by the combusion of carbonaceous materials."

In the report of a Canadian technical commission appointed to investigate the subject, Professor Harbord in 1904 said:

1. Steel, equal in all respects to the best Sheffield crucible steel, can be produced, either by the Kjellin, Heroult or Keller processes, at a cost considerably less than the cost of producing high-class crucible steel.

2. At present, structural steel to compete with Siemens or Bessemer steel cannot be economically produced in the electric furnaces, and such furnaces can be used commercially for the production of only very high-class steel for special purposes.

These early predictions have been well borne out by the recent developments. As compared with the bessemer and open-hearth processes, the electric-furnace process may be nearly three, or in some cases even more, times as costly. In spite of this apparent handicap it has made wonderful strides, as already cited. It may be worth while to look more deeply into the reasons for this rapid progress. Some of these have been hinted at in the foregoing.

Comments by Dr. Mathews.

John A. Mathews, president of the Halcomb Steel Company, in a paper recently presented before the American Electrochemical Society, pointed out why the electric furnace with proper handling produces a superior product for the most severe requirements of automobile, airplane and munition manufacture, as follows:

First—Experience shows that chemical composition of consecutive heats can be held more closely to a standard than with any other process. This is most noticeable when handling easily oxidizable metals, like vanadium, chromium, silicon and manganese.

Second—From the above it is apparent less of these metals will have to be added to insure a given final minimum, hence there will be less of the oxides of these metals produced in the steel and to be removed from the steel.

Third—The more nearly composition can be controlled, the more certain are likely to be the results of subsequent heat treatments.

Fourth—Electric steel is usually chemically purer than any other steel. Sulphur, especially, is readily removed. There has been considerable written of late to show that the effects of sulphur are not as harmful as generally believed. Be that as it may, when the sulphur is uniformly distributed, yet it is obvious that segregation of elements is impossible if they are absent. It also follows, if segregation of sulphur and phosphorus are not to be feared, the percentage of cropping may be reduced and the yield of sound metal increased—a step in the direction of economy and conservation.

Fifth—Low sulphur in electric steel usually means a prior reducing condition favorable to complete deoxidation. This condition is favorable to sound ingots, freedom from blow-holes and seams produced from them. Quiet metal has less tendency to segregate in the mold, as to either metallic or non-metallic elements, and produces steel free from "ghost" lines or laminations.

Sixth—Alloy additions may be made in the furnace itself rather than in the ladle, which increases the chance of thorough assimilation, diffusion and homogeneity.

Seventh—From a combination of the above reasons, it unquestionably results that electric steel is less easily injured by overheating than is the case with other steel. It will stand more heat in the forging or heat-treatment without injury; that is, it has a wider safe heat range. This opinion has the weight of both experimental evidence and practical experience in the hands of competent observers among users.

Eighth—Electric steels are usually freer from slag and non-metallic inclusions than are Bessemer and open-hearth steels.

Ninth—All of the above characteristics make for quality, when quality is the first consideration. The electric furnace possesses an economic value in its adaptability for handling and recovering alloy scrap values. Some alloy scraps do not make desirable additions to open-hearth furnaces or, if made, a large share of the alloy metal is lost in the slag. With the widespread and increasing use of alloy steels it is highly desirable that alloying elements be not lost when contained in the scrap.

These advantages and others follow because, as Siemens observed, "the fusion is effected in a perfectly neutral atmosphere," and because, Dr. Mathews says, a number of distinguished engineers and inventors produced commercial, workable furnaces in which these results could be attained on a large scale.

Experiences in Steel Castings Plants.

At the same meeting of the Society, R. F. Flinterman, president of the Michigan Steel Castings Company, Detroit, told of having first used the crucible furnace. The great difficulty was in the crucibles themselves; they lacked uniformity and were expensive because they average only about three heats. Since that time the cost of crucibles has greatly increased and it is difficult to obtain them. A Tropenas converter was then used and finally two electric furnaces were installed to replace all the earlier equipment. The results obtained are explained by Mr. Flinterman as follows:

As regards the quality of the electric steel, there is no question of its superiority over the converter metal. This applies to both acid and basic electric steel. It is only natural that this should be so, if you compare the two methods. In the converter at the end of blow there is a mass of metal at a high temperature, covered by a highly oxidized slag and the metal itself undoubtedly containing oxides. The addition of ferro-silicon and ferro-manganese at this point deoxidizes the metal more or less completely, but the metal is still in contact with a slag carrying a high percentage of iron oxides, etc.

In the electric furnace the covering slag is completely deoxidized before ferro-silicon and ferro-manganese final additions are made. The metal is constantly giving up oxides to the slag during the deoxidizing period and is practically free from oxides before the final deoxidizers are added.

In our opinion it is the more complete absence of oxides in the electric steel which accounts for the superiority of this steel over converter steel. The results obtained on physical tests are universally better.

The superiority of the electric steel was also manifested in the case of long, thin-section castings. Our loss due to shrink tears was reduced when we were using electric steel. On one particular pattern we made 100 castings from electric steel and found no shrink tears whatever. With exactly the same practice we found 90 out of 100 castings made from the converted steel had slight tears or cracks, which had to be welded in order to save the castings. We might add that this particular casting was very difficult to make and was perhaps an extreme case, but the test we made brought out this difference in behavior most vividly. The reason for this behavior is due no doubt to two facts:

1. The low sulphur contents of electric steel.
2. The absence of impurities, particularly of oxides. The absence of oxides undoubtedly gave the electric steel a much greater strength at higher temperature, and this greater strength was able to resist the pull, exerted on the steel during that period, when the castings were shrinking or shortening. This behavior of electric steel was true with both acid and basic steel, particularly with the latter, where we could maintain a lower sulphur.

Thus far, we have emphasized the high quality of the electric steel, which was the one essential point

which induced us to abandon the converter process in favor of the electric furnace. Our hopes in this regard have been most fully realized. We feel further that the time is now at hand when this fact will be fully realized by the trade at large, as is evidenced by the increasing demand for electric steel.

It was especially pleasing to have the higher quality steel without any increase in cost. Under present market conditions, with low-phosphorus pig iron selling at an exorbitant price, the electric steel can be produced at much lower cost than converter steel. As our practice improves we feel confident that we can compete with converter steel even under normal market conditions.

With the electric steel our results have been very gratifying. We have been able to obtain any desired analysis regularly, and in consequence our subsequent heat treatments have given us the high physical qualities which we were after. This opens up a large new field for the maker of small castings, since there is a large demand for alloy castings for certain purposes, when lightness and great strength and toughness are necessary.

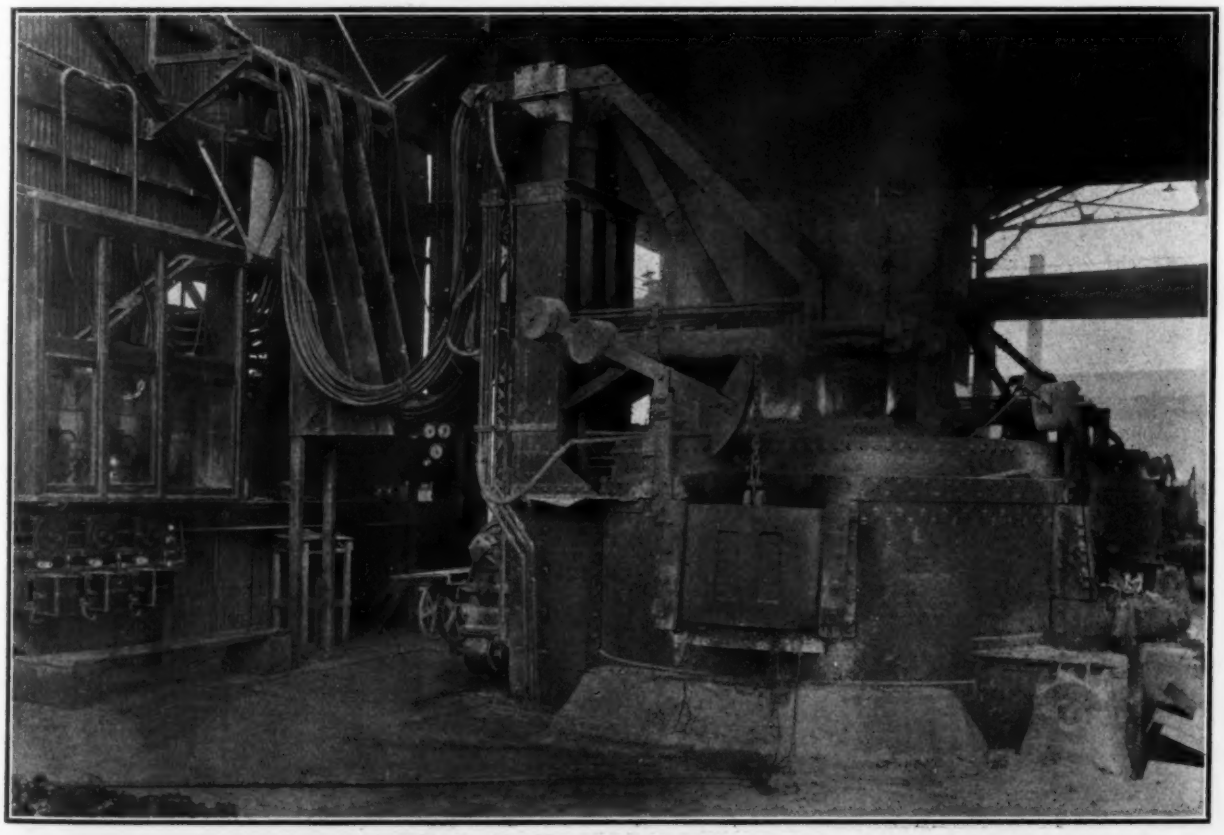
J. M. Olmsted, of the Electric Steel Company, Chicago, also attests the superior quality of electric steel castings. Formerly when using a converter there were from 27 to 32 per cent of castings rejected due to slight flaws that could not be discerned until after much machining had been done. His company recently completed 12,000 castings for gear blanks in which the rejections were reduced to less than one-tenth of 1 per cent. The electric furnace makes very uniform steel with a better bearing surface and the quality of the castings is such as to eliminate the need for subsequent heat treatment, which is especially important in gears.

Prospects and Opportunities for Further Development.

An excellent summary of the electric steel situation was given at the end of Dr. Mathews' paper referred to above. It is especially valuable in showing the importance of water-power development to this fast growing industry. Dr. Mathews said:

The electric furnaces are at hand—over a hundred of them in the United States—for making large quantities of the highest grade of steel and alloys to meet the growing demands of the industries requiring special quality. It is too early to expect that the product of all the recent furnaces is up to the standard that may reasonably be expected after adequate experience. Equipped as we are, we must become the leading nation in both quality and quantity of electric steel production, as we now are in crucible, open-hearth and Bessemer steels.

With wise state and national policies affecting hydroelectric developments, we may see a great electric-steel trade develop without impairing our coal reserves. At the same time, we shall conserve alloy materials, recover good steel from low-grade scrap, and produce a maximum yield of especially sound steel from a minimum of raw materials used. If the government will take an enlightened view of conserving our coal by developing or permitting the development of those great and inexhaustible sources of power—the waterfalls—the electric steel manufacturers will do their bit toward practical conservation. The electric furnace can utilize power, which, once over the falls, is gone forever; reclaim materials, which, in fuel-fired furnaces, are irretrievably lost, and produce from them products necessary to the advancing demands of the arts of peace, as well as to the national defense.



Six-Ton Three-Phase Arc Furnace With Thury Automatic Regulator at Plant of Anniston (Ala.) Steel Company.

Possibilities of the Electric Steel Furnace

Number of Installations Increasing Over 100 Per Cent—Opportunities for Central-Station Power

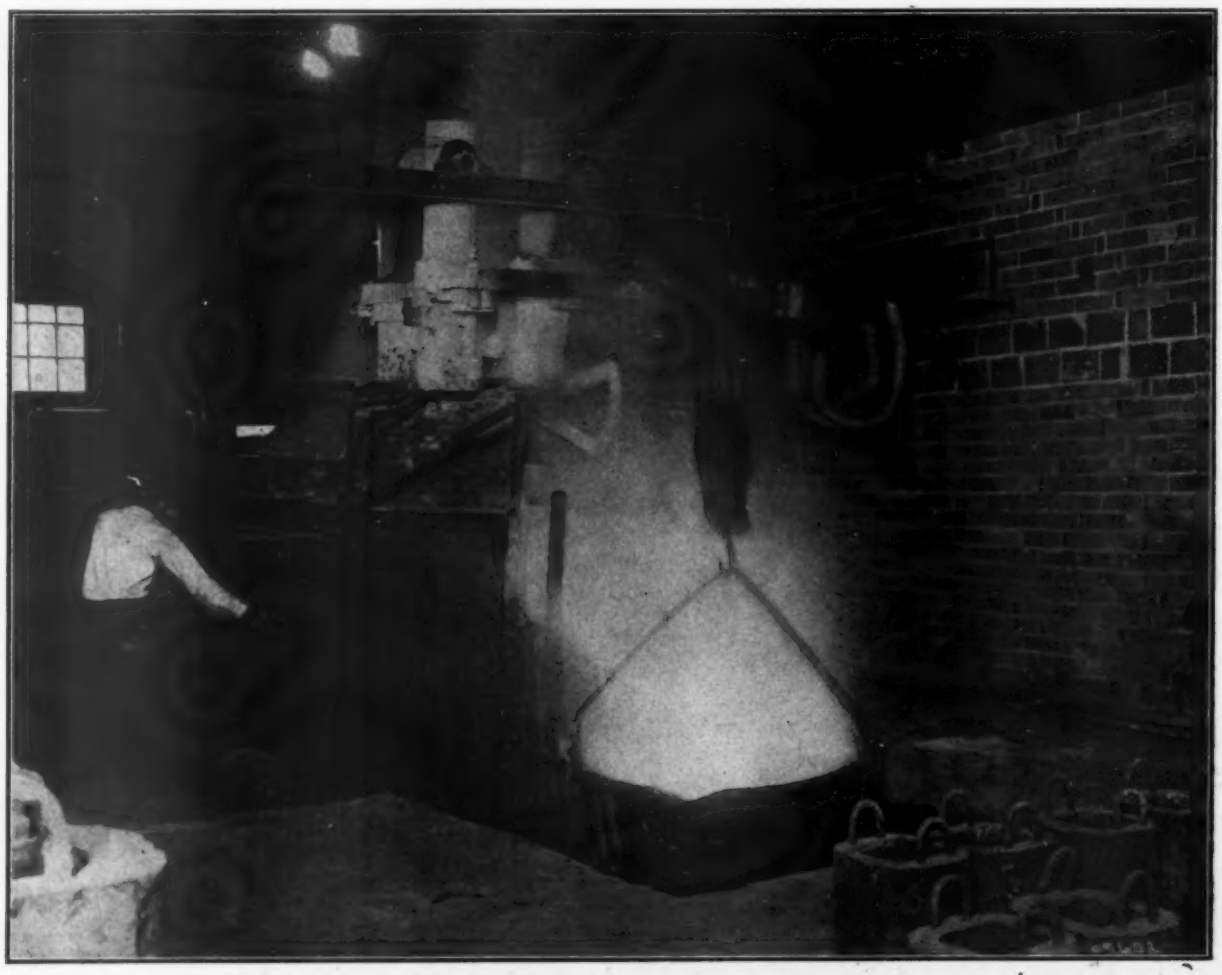
By R. L. MONTGOMERY

IN reviewing the adoption of electrical science to any commercial and industrial application or process it is safe to say that when once surely founded its growth is almost invariably rapid, and not infrequently phenomenal. Thus has it been in the case of electric lighting; in the utilization of dynamo-electric energy as mechanical energy in the factory and the home and for general utility in economizing time, effort and money; in the transportation upon the streets below the earth's surface and on the railroads; and in the electro-chemical industry.

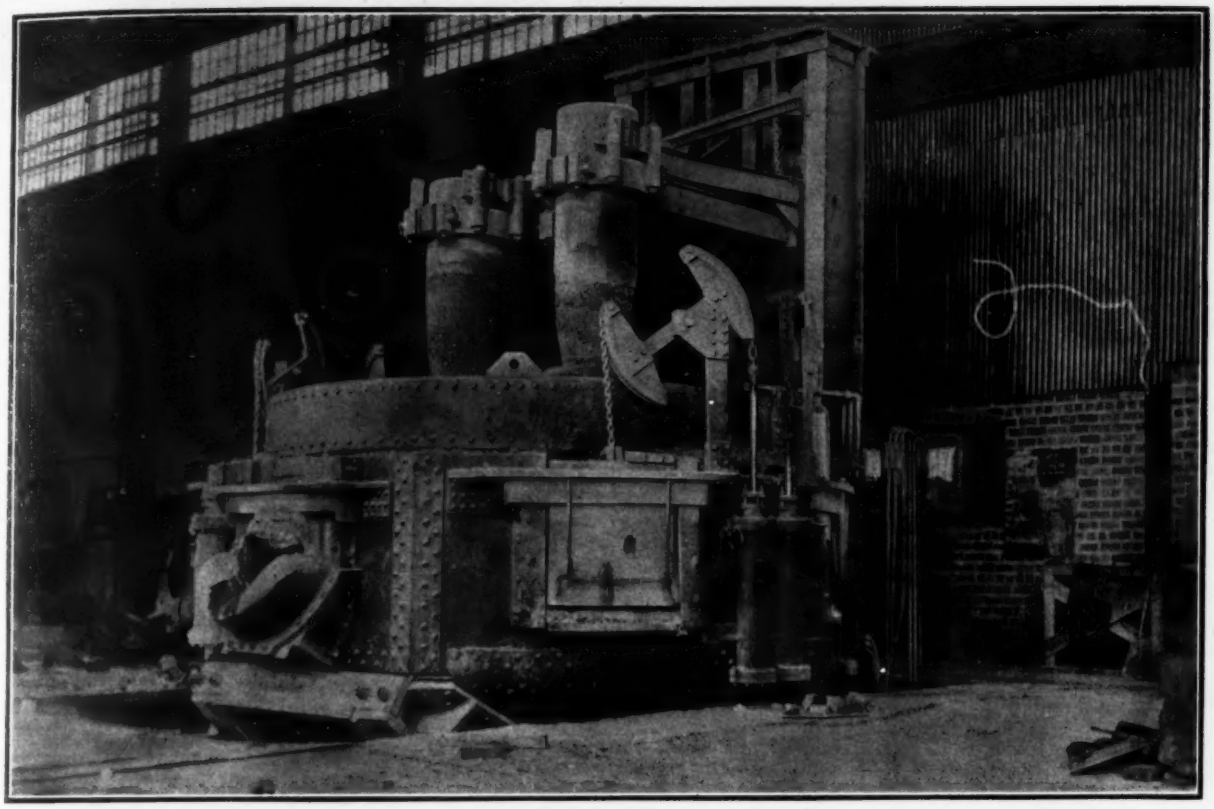
That the application of electricity should thus meet with such pronounced rapid growth is not far to seek. First, it offers perhaps the most convenient form of energy for generation, transmission and utilization, although electricity as such form of energy is not so very largely used; it permits of transformation into heat, light, mechanical forms of energy conveniently and ease, at low expense and often most efficiently; it is clean, hygienic and flexible; it permits of accurate and close control from at hand or afar with equal ease, and in the form of electricity can be more easily controlled than in the forms in which it finds greatest use. And then again, it may perhaps be the only means that make certain processes possible, as for example the electric arc with its high temperature required in the manufacture of calcium carbide, carborundum, etc.

Not an exception to the phenomenal growth of industries in which applied electrical science has become surely founded is that of the steel industry, although here the development has been slower than usually is the case due primarily to no fault of applied electricity, but to the mistrust and suspicion, the absence of necessity and the conservative nature of the steel industry.

It was probably about 1843 that the electric steel furnace was first tried out. It was hardly until the year 1878 that furnaces began to appear possessing features that exist today. In 1887 appeared Heroult



A Five-Ton Electric Melting and Refining Furnace in Operation.



A Six-Ton Electric Arc Furnace.

furnaces for the manufacture of aluminum and in 1894 Heroult furnaces for the production of calcium carbide. It was between 1898, 1899 and 1900 that began to appear the furnaces of Heroult, Stassano, and Kjellin almost simultaneously of the types that still remain in many respects the same today.

Development of Electric Steel Furnace.

Notwithstanding the actual usage of the electric furnace in 1887 for manufacturing aluminum and the other types in 1898-1900, the electric furnace could hardly be said to have become widely and surely founded for making steel except in those localities where ample water power was available, and even so progress was rather slow because the iron makers had not felt the need for new methods, they rather mistrusted the electric furnace, nor knew in what way it would affect their product for the better or the worse. By 1904, however, the electric steel furnace had become founded upon a sure basis, and therefrom has advanced rapidly, forging ahead.

The electric furnace has been very largely a foreign development, until recent years. America has not been slow to adopt and improve and employ, however. In 1912 the output of electric steel in the United States was 18,309 tons, in 1915 it had increased to 69,000 tons, and for 1916 has been conservatively estimated at 225,000 tons. At the beginning of the current year there were not less than 136 electric steel furnaces in America, an increase of nearly 100 per cent over the 73 the previous year. Today the United States holds first place of any country with the greatest number of electric steel furnaces, and a position unchallenged.

But this is not all the story. One 20-ton furnace went into service toward the close of last year. Two similar furnaces, each with a capacity of 225 tons per diem, are to go into service at South Chicago, Ill., during the present year, and at this rate the output of electric steel during 1917 is expected to double that of last year. And more important still, the largest electric steel plant in the world has been authorized by the United States Steel Corporation for South Chicago to have an annual capacity of 210,000 tons, equivalent to almost the entire output of electric steel last year.

These facts are inspiring, and must create enthusiasm in even the most optimistic. They leave no doubt but that the steel industry has awaked to a realization of the value of the electric furnace. They want it, need it, and mean to have it fast. But as important as these statistics are, more important still is a fact that might pass unnoticed. It is that the electric furnace is finding, has found, a wider field. At first it appears to have been thought that the electric furnace was best suited for making steel castings of high grade, and work for the foundry. But it has already branched out, successfully competing with other methods in manufacturing high quality tool steels, the highest grade of rails of uniform quality. This fact is epoch-making, for it marks the entry of the electric furnace into the steel mill as well as the foundry.

The Central Station's Opportunity.

For the successful development and application of the electric furnace upon the wide commercial scale that is now taking place in the steel industry, is needed a supply of electrical energy in vast quantities that is at once reliable, continuous and cheap. The load constituted by the electric furnace is a heavy one, and the load-factor high. The demand is one with characteristics that are desirable, and that the central-station companies are eminently well able to fulfill to the best advantage of the steel industry and

to themselves. The electric steel furnace can hardly be claimed to be protege of the central-station companies; in fact, they have been rather slow to appreciate its value to them, compared with the wonders they have worked in the past in helping along a cause that needed succor. The electric steel furnace needs no help, for the steel industry has found it, but as a load it should be welcomed with wide-open arms and courted painstakingly by the wide-awake central-station companies.

The electric steel furnace is coming—has come—because it makes possible steel of higher quality, greater uniformity as regards chemical composition and absence of segregation, obtainable in less time, often at lower cost and from inferior ores than is possible by other means. While the electric steel furnace has come because the steel men find they want it, the central-station companies want it also and should not only accept it enthusiastically but go after it strenuously. It means much to them, and will mean vastly more as time goes on. The electric furnace in the foundry usually bespeaks central-station service because conditions are not such generally that the foundry is able to generate conveniently and economically the large amount of reliable long-time power such as the electric must be assured if the most economical and entirely successful performance is to be obtained. On the other hand the steel mill nearly always has its blast-furnace gases that result from melting their ores, and these gases, otherwise a waste product, can be economically utilized for the generation of electricity. Notwithstanding this central-station service is very often employed to augment and supplement the sometimes rather erratic and fluctuating capacity of the steel mill, and as an auxiliary in times of emergency. While cheap energy is important, of more importance still is that the supply should be reliable and continuous. It is this fact that leads one to expect the electric-furnace load will eventually pass to the central-station companies in large measure. It is to the best interests of the steel as well as to the central-station industry that it should. That the largest electric steel plant in the world should be planned for South Chicago, where at another plant of the same company central-station service is used to augment its own, and supplied by one if not actually the largest central-station company in the world whose load-factor is the highest of any central-station steam plant, is ominous. It may be a coincidence, but it bodes well for the steel mill and the central station serving it.

The steel industry and the central-station industry are predestined to advance together. The one requires vast amounts of cheap reliable electrical energy, the other desires large energy consumers, with a load that is preferably heavy, steady and continuous. The steel industry has not been slow to appreciate its need of the central-station companies. Already more than 51 steel mills are purchasing central-station service to the extent of more than 300,000,000 kilowatt-hours annually—a goodly output. The central-station industry is yet young, the electro-steel industry but in its infancy. Already their growth has been phenomenal indeed; the promise for the future beggars words.

Traction Company Will Carry Express.—Indianapolis, Columbus & Southern Traction Company, of Indiana, has contracted with Wells-Fargo Express Company to handle express service between Seymour and Indianapolis.

Gasoline Engines Generate Electricity During Test.

The accompanying illustration shows the new test room of a gasoline-engine factory at Milwaukee, Wis., equipped for generating electricity during tests. Each

Gasoline Engines Generating Electricity During Test.

test stand has an individual electric generator. When an engine is completed in the assembly department, it is sent to the test room and connected up with the motor-generator which acts as a motor and drives the engine until it is sufficiently free to allow it to be run under its own power. A uniform product is assured as each instrument board is equipped with meters which give the actual power required to drive the engine.

It is pointed out that when the engines are sufficiently free, they are started and run under their own power, driving the motor-generator as a generator. The load is then gradually increased until the motor develops the required power and then it is run under full load for several hours. The engine is then picked up with an electric crane, of the monorail type, and taken to the final inspecting department, where the motor is disassembled and all moving parts are given a thorough inspection and adjustment, after which motor is again placed on the test stand and run again for several hours.

It is claimed that the large number of special motors built, made it necessary to have a test stand which can easily be adjusted to any width of supporting arms and to any drop or rise. The motors are connected to the generator with an ingeniously designed coupling which is readily assembled in a few minutes. All the current that is generated by the generators during tests is reverted into the factory line and used to drive the machinery, giving the benefit of power which otherwise would have been wasted.

Each engine has an individual exhaust pipe leading to the outside of the building. These pipes are underground. A connection is arranged at each test stand for water, gas and gasoline. The motors are run on illuminating gas unless a fuel-economy test or carburetor test is desired. A new experimental laboratory has just been completed at this plant, which is equipped with a 300 horsepower dynamometer so arranged that a motor can be mounted on either end and driven in either direction. Complete equipment has been added for making horsepower and torque curves, fuel-economy curves, oil-consumption curves and friction horsepower curves.

New Toledo Plant Will Use 400,000,000 Gallons of Water a Day.

An idea of the immensity of the power house under construction for the Toledo Railways & Light Company may be gained by some figures received at the New York office of Henry L. Doherty & Company from E. R. Kelsey, publicity manager of the Toledo company. According to Mr. Kelsey the boilers and condensers of this power house will use twenty times as much water as it takes to supply the entire city of Toledo. It will use 400,000,000 gallons of water every day. This water will flow through a channel 70 feet wide and 26 feet deep. In the winter trouble will be avoided by using hot water to melt the ice before the water reaches the boilers.

The construction of the power plant is progressing rapidly, and the first of the eight stacks is now about half built.

Indiana Association's Petition for Rate Increase Must Be Refiled for Each Company.

The Interstate Public Service Company, which controls the United Gas & Electric Company, serving Jeffersonville and New Albany and a nupmber of other towns in Indiana, has withdrawn from the petition of the Indiana Electric Light Association for a 30 per cent increase in the rates of the members of the association. The Louisville & Northern Railway & Light Company has also withdrawn from the petition.

This petition was filed before the Indiana Public Service Commission, which has ruled that it is without jurisdiction and that the various companies will have to file seperate petitions, so that each case may be considered on its merits.

A UNIQUE RAILWAY SUBSTATION.

Railway Load Fed by a Substation Receiving Power from a Single-Phase Source.

The operation of a three-phase rotary converter railway system from a power house used primarily to supply single-phase current for the operation for a trunk line railroad is of more than passing interest.

The Stamford substation of the Connecticut Company is one of three rotary converter substations now installed, and designed for operation from the three-phase 11,000-volt, 25-cycle circuit fed from the Cos Cob power station of the New York, New Haven & Hartford Railroad. The other two are the Port Chester substation of the New York & Stamford Railway Company, with a capacity of 1,500 kilowatts, and the White Plains substation of the Westchester Street Railway Company, with a capacity of 1,200 kilowatts. The Stamford substation contains three rotary converters (Fig. 1) rated at 300 kilowatts each, and with each rotary converter are three oil-insulated transformers, shown in Fig. 2, and a suitable three-phase reactance.

In laying out this station a number of problems had to be considered: the resistance of the line between Stamford and Cos Cob was very low, the distance being only 3.5 miles, and the unbalancing of voltage due to the single-phase railroad system was considerable, as well as very fluctuating. Surges of voltage were for the same reason often encountered, and the conditions which would exist when one leg of the transmission line was opened, had to be considered and provision made for them.

By providing sufficient taps on the 11,000-volt side of the transformers, it was found possible to re-

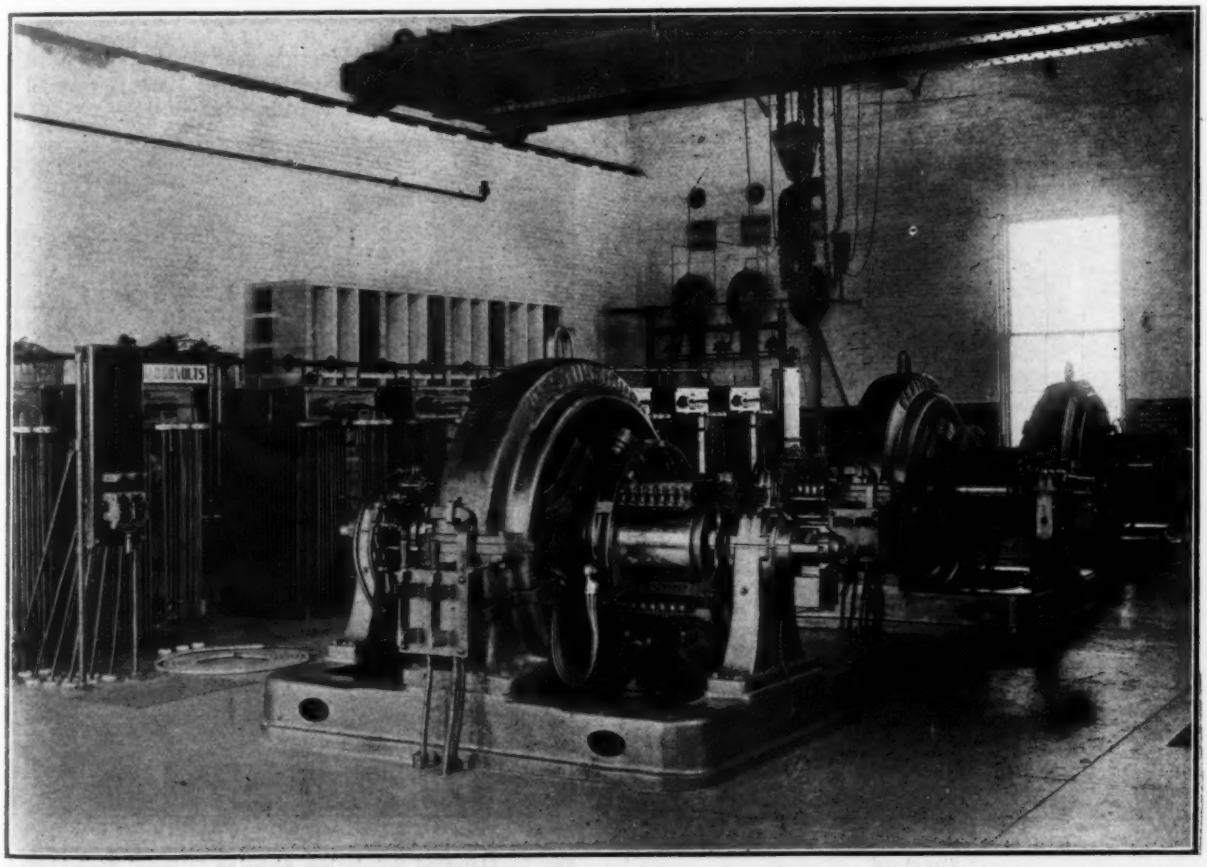


Fig. 1.—Stamford Substation, The Connecticut Company, Showing Three Rotary Converters, Transformers and Lightning Protective Apparatus.

duce the maximum unbalancing of the line so far as the rotary converters themselves were concerned, to a value somewhere about one-half that on the primary circuit, and this arrangement, together with the reactance coils and liberal design of the rotary converters, has given very good results. In order to take care of the single-phase condition resulting from the opening of one leg of the transmission system, the specifications called for an equipment which would disconnect one leg and for rotaries which would be capable of carrying full load for five minutes being supplied with single-phase energy. The ability of the machine to do this has been amply demonstrated, there being only a slight momentary, and by no means objectionable, sparking when one leg is opened under conditions of full direct-current load. The disconnection of any one leg is obtained by the use of three single-pole, electrically operated oil circuit-breakers, on the incoming line, and by means of under-voltage relays controlling the breakers in the power and trolley circuits respectively.

The incoming three-phase 11,000-volt line is controlled by single-pole, outdoor type electrically operated oil circuit-breakers, similar to those used on the bridges of the electrified portion of the New Haven Railroad, but they are set at a rather high tripping-point, so that under normal conditions the station is handled and overload protection afforded by electrically operated oil circuit-breakers (Fig. 2), mounted in the busbar structure in the building. These are operated and tripped from power supplied by a storage battery in the station.

The switchboard, shown in Fig. 3, consists of a small panel for control of the outdoor-type single-pole oil circuit-breakers.

Lightning protection is afforded by a specially designed electrolytic arrester.

After being in service a considerable period, it does not appear that there is any difficulty in obtaining successful operation of a rotary converter substation feeding a railway load. Careful consideration was given to the various points, by the engineers of the Connecticut Company and of the Westinghouse Electric & Manufacturing Company, and no change has been found necessary in the plans adopted before the installation of the apparatus. It is interesting to note that under the new arrangement of connections now being installed by the engineers the requirements of single-phase operation of the rotaries will not be necessary in contemplated substations, as this condition will not then arise.

Fig. 2.—Stamford Substation, Showing a Portion of Busbar Structure.

Fig. 3.—Stamford Substation, Showing 14-Panel Switchboard.

Wave-Lengths of Lines in Helium Spectrum.

Exact measurements of the characteristics of the light emitted by various substances are of importance in many branches of science and technology. One of the most useful sources of light for laboratory purposes is the gas helium. This element was discovered first in the sun and stars, later on the earth, and has recently become of great interest in physical and chemical science.

A new publication just issued by the Bureau of Standards (Scientific Paper No. 302) is entitled "Wave Lengths of the Stronger Lines in the Helium Spectrum" and gives precise measurements of the wave-lengths of the light emitted by this substance when raised to incandescence by an electric current. The lengths measured are very minute, but by specialized methods they can be measured to an accuracy of one three-millionth of the whole value. Quantities as small as one ten-billionth of a millimeter are appreciable in these measurements. The results will establish standards for spectroscopic work which can be easily reproduced in any laboratory.

Commission Approves Merging of Traction and Light Interests.—The Ohio Utilities Commission has issued an order approving the reorganization of various Ohio Valley traction and light companies under the name of the Steubenville, East Liverpool & Beaver Valley Traction Company.

Editorial Comment

Fair Prices and Reasonable Return

IT IS generally conceded that the rates charged for service by public utilities should be such as to provide a reasonable return upon the investment in the enterprise and meet all legitimate running and overhead expenses. Where men differ is chiefly in the application of this principle. Probably no specific figure, such as 6, 7 or 8 per cent, can be taken as the fair rate of return for every case, but it helps one's approach to the problem to consider such a view of return as President Wilson recently uttered in his statement upon profits to be derived from war business. Mr. Wilson is quoted as follows:

"A just price must, of course, be paid for everything the Government buys. By a just price I mean a price which will sustain the industries concerned in a high state of efficiency, provide a living for those who conduct them, enable them to pay good wages, and make possible the expansion of their enterprises, which will from time to time become necessary as the stupendous undertakings of this great war develop.

"We could not wisely or reasonably do less than pay such prices. They are necessary for the maintenance and development of industry, and the maintenance and development of industry are necessary for the great task we have in hand."

Here in a nutshell is an excellent statement of the economic fundamentals of public utility service. Less than a fair price as defined above means that the quality of the service must deteriorate or that either the employee or the investor must suffer. The final test is the ability to procure new capital for betterment or for expansion. When the conditions are made so hard that the investor shies at the opportunity to enlist his money in a public service enterprise and calmly devotes it to something else, the day of reckoning cannot be far distant. For many years to come America will continue to spell opportunity for the development of useful service. As the nation grows that service simply must be had, and we believe it will be had far more efficiently through private ownership under public regulation than through the burdens of increased taxation which seem inseparably associated with the balance sheets of governmentally managed enterprises.

Nothing is more important in the interests of efficient continuing civilization on this continent than that public utility improvements shall be forthcoming as soon as possible after they become needed. If through a meager (or worse) return capital cannot be induced to supply the necessary service, there will be a time lag in furnishing it through governmental aid which will cost the country as a whole dear. Such is the situation today in the steam-railroad field, where the expenditure of probably hundreds of millions of dollars is needed in the judgment of expert managers to enable the companies to cope efficiently with the enormous burden of traffic which they saw coming, but which they have been unable to provide adequately to handle because denied the opportunity to increase their rates sufficiently ahead of the peak load to be ready for the rush of business now offered. It is indeed cause for congratulation that matters have not reached this state in the field of electric service, and if rate-making tribunals will hew to the line of President Wilson's recent declaration, the continued rapid growth of the electrical industry will be positively assured, and with lasting benefit to the country.

Preparing Data for Consolidation Hearings

TO some utility managers, required for the first time to present a case to a public service commission in a consolidation proceeding, the proper course in the way of preparation is somewhat obscure. This is not so often the situation with respect to a central-station company as it is in the case of water-power organizations which perhaps have never been under commission regulation in the past. The practical question is how to fit oneself to meet the inquiries of the board when the hearing date arrives, and while it may appear filled with uncertainties to executives with little commission experience, the problem is really not a difficult tone.

Commission proceedings, in most cases certainly, are much less formal than those of a court. The main thing is to be prepared to furnish all the facts which may be required for the record, and in some circles there may be too much inclination to fall back upon counsel, bringing forward mainly legal evidence. Take the case of a water-power company which acquires control of a central station in its territory through stock purchase, and assume that until recently such a company has never been required to account for its doings to the utilities commission now in jurisdiction. Very likely the state legislature has authorized the purchase, subject, however, to the finding of the commission that public convenience and necessity require the unification of plants and distributing systems.

What is needed is a well-rounded presentation of the facts of the case. The manager of the water-power company, who, we will say, has never before had to appear before the commission, starts with his

purchase agreement. Presumably this has been executed under competent legal supervision, and that a petition for approval of the transaction has been forwarded or submitted to the commission in person through an accredited representative of the company. If the headquarters of the commission are not too far from home, and an informal meeting can be arranged, then the executive can outline to the chairman the general program contemplated and receive verbal suggestions as to the kind of information which is likely to be required at the forthcoming public hearing.

When the hearing date arrives, the information needed may of course take unexpected turns of inquiry, but certain data are of fundamental importance. Such are the charters (copies will do) of each company concerned in the deal; the original agreement of purchase, with a copy for the files of the board; data bearing upon the history of each company, its finances, operating situation, growth, business policies, rates, capitalization and physical plant. It is important to be able to show that after the purchase has been completed and approved, the rate-paying public will not be obliged to furnish revenue to carry the charges upon any overcapitalization resulting from the consolidation. It will be well to bring to the hearing copies of any engineering reports upon the benefits of the consolidation, and, if any have been made, copies of appraisals of fairly recent date.

It is seldom that any one official of a company can immediately answer all the inquiries which may be directed toward these different branches of the company administration, and if several officials can be spared for the hearing, it is first-class practice to arrange their presence. Too often important proceedings and subsequent commission findings are delayed because of the absence of company officials having a first-order knowledge of points at issue. In a consolidation hearing, the question of the quality of the future service is a factor of importance, no less than proposed rate changes, if any. Let the operating superintendent, the chief engineer or his equivalent, the president or general manager, and a responsible legal and accounting officer attend. Then if the commission asks the size of wire and the number of miles of steel towers in the high-tension lines, the tower spacing, and the character of the country in which the tower foundations are, or will be, set, an answer can be given at once. The analysis of construction cost estimates which probably will be required will proceed much faster with expert technical assistance at hand. Photographs and maps which will show the present properties to the commission have their place, with cross-section drawings and plans, so far as completed, of plant enlargements or new construction. Buttressed by information of the foregoing type, any manager can appear with a business man's confidence before a commission and leave the preparation of supplementary information to follow collateral inquiries at the hearing itself.

The Study of Dielectrics

WHILE the important role of insulating materials has been recognized from the very beginning of the electrical industry, the investigation of their properties has not kept pace with our knowledge of conductors and of magnetic media. Although the nature of magnetism is still somewhat obscure, the properties of such magnetic materials as we are familiar with have been pretty thoroughly investigated, and their employment in design does not involve very great uncertainties.

Recognition of analogous properties in dielectrics has been more slow. Although dielectric hysteresis has been known for many years, it is only in more recent years that it has received the attention from designers which it deserves. Cable makers were the first to appraise the industrial importance of this property, but now it receives consideration from designers of high-tension insulators and others. It is only within the last few years that adequate spacial considerations have been given to insulating materials and that their shapes have been adapted to individual applications. Even yet all the properties of dielectrics have not been fully investigated. Thus there is a condition of electro-striction or change of dimensions when an insulator is placed in an electric field, corresponding to the change of size of magnetic materials when placed in a magnetic field.

Some interesting experiments upon this property of dielectrics have been performed during the war in one of the French laboratories by Mr. L. Bouchet. The principal materials used were glass and ebonite, and the change in dimensions was determined in both the longitudinal and transverse directions; that is, parallel and normal to the direction of the electric field. There was contraction parallel to the field and expansion in the transverse direction. The material to be measured was made the dielectric of an electrical condenser, so that the attraction between the conducting plates would produce such an effect. The measured contraction, however, was too large to be accounted for by this mechanical force, although increasing as the square of the strength of field. The expansion in the transverse direction was found to vary inversely as the modulus of elasticity of the material.

The magnitude of these effects was not sufficient to require attention in practical design since it amounted to only a few parts in one million or even less. It is true that trouble has arisen in electrical machinery from insulation becoming loose, but such occurrences are to be attributed to subjection to too high a temperature rather than to any effect of the kind here considered. The importance to the industry of such work lies rather in rendering more complete our knowledge of the materials with which the designer and constructor must deal in the manufacture of electrical apparatus, and in restricting the region of uncertainty which has always made empirical procedure such a large element in current practice.

HAPPENINGS IN THE INDUSTRY

Action Against Illinois Coal Operators—Hydroelectric Commission Buys Ontario Power Stock—Specifications for Electrical Material on Government Ships—Miscellaneous News

DRASTIC ACTION THREATENED AGAINST COAL-MINE OPERATORS IN ILLINOIS.

Illinois State Council of Defense, After Numerous Fruitless Conferences Prepares to Take Strong Action for Reasonable Coal Prices.

A subcommittee of the Illinois State Council of Defense after numerous meetings and conferences with the coal-mine operators of the state, in which efforts were made to secure a reduction in the prevailing prices of coal to meet the national emergency, has issued a report, which the Council has formally approved and adopted, reciting:

That the price of coal is excessively high. It includes a profit per ton much in excess of a fair and reasonable profit.

That the only increase in the coal miners' wage scale since July 1, 1916, to date has not exceeded 20 cents a ton, which increase cannot account for the jump to $2.15 per ton in the price of coal at the mine between July, 1916, and 1917.

Through its chairman, Samuel Insull, president of the Commonwealth Edison Company, the Council has laid the matter before Governor Lowden, the attorney-general and other state officials, with recommendation that drastic action, if necessary, be taken to cut down the exorbitant coal prices.

COMMITTEES OF ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES.

New Standing Committees Selected by Board of Governors to Serve for Ensuing Year.

At a recent meeting of the Board of Governors of the Associated Manufacturers of Electrical Supplies, held at the offices of the Association, 30 East Forty-second Street, New York City, standing committees for the ensuing year were appointed as follows:

Membership Committee—W. C. Robinson, chairman, National Metal Molding Company, Pittsburgh, Pa.; C. H. Bowen, Collyer Insulated Wire Company, Pawtucket, R. I.; Oscar Hoppe, American Circular Loom Company, New York City; H. T. Paiste, H. T. Paiste Company, Philadelphia, Pa.; W. S. Sisson, D. & W. Fuse Company, Providence, R. I.; W. D. Steele, Benjamin Electric Manufacturing Company, Chicago, Ill.; J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn.

Finance Committee—Charles Blizard, chairman, Electric Storage Battery Company, Philadelphia, Pa.; W. C. Bryant, Bryant Electric Company, Bridgeport, Conn.; Charles L. Eidlitz, Metropolitan Electric Manufacturing Company, Long Island City, N. Y.; R. E. Gallaher, New York Insulated Wire Company, New York City; J. Nelson Shreve, Electric Cable Company, Bridgeport, Conn.

Legal Committee—D. C. Durland, chairman, Sprague Electric Works, New York City; D. H. Murphy, American Conduit Manufacturing Company, Pittsburgh, Pa.; Gerard Swope, Western Electric Company, New York City.

Taxation Committee—J. F. Kerlin, chairman, National Carbon Company, Cleveland, O.; J. W. Brooks, Pass & Seymour, Incorporated, Solvay, N. Y.; Oscar Hoppe, American Circular Loom Company, New York City.

Tariff Committee—J. J. Gibson, chairman, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; L. Livingston, Edward F. Caldwell & Company, Incorporated, New York City; J. E. Way, R. Thomas & Sons Company, New York City; F. H. Chapman, Yost Electric Manufacturing Company, Toledo, Ohio; S. H. Blake, General Electric Company, Schenectady, N. Y.; E. F. Wickwire, Ohio Brass Company, Mansfield, Ohio; R. C. Buell, The Johns-Pratt Company, Hartford, Conn.

Entertainment Committee—D. C. Durland, chairman, Sprague Electric Works, New York City; LeRoy Clark, Safety Insulated Wire & Cable Company, New York City; J. W. Perry, H. W. Johns-Manville Company, New York City; Charles E. Dustin, general secretary, New York City. Also the president, ex-officio.

Advisory Committee—LeRoy Clark, Safety Insulated Wire & Cable Company, New York City; D. C. Durland, Sprague Electric Works, New York City; J. W. Perry, H. W. Johns-Manville Company, New York City; R. K. Sheppard, Simplex Wire & Cable Company, Boston, Mass.; Charles E. Dustin, general secretary, New York City.

HYDROELECTRIC COMMISSION BUYS ONTARIO POWER STOCK AND BONDS.

Large Electric Plant at Niagara Falls, Ontario, Taken Over at $23,000,000. New Directors Elected.

Transfer of the Ontario Power Company, at Niagara Falls, to the Hydro-Electric Commission of Ontario, was effected August 1 at Toronto, where the Commission elected directors of the company to succeed John J. Albright of Buffalo and his associates. The Commission bought the stock and will keep the company in its old form as a corporation, merely electing a new directorate. The sale was effected some weeks ago.

For the company the Hydro-Electric Power Commission paid $23,000,000, taking over the entire issue of stocks and bonds. Stock was bought by the commission at $80, payment being in 4 per cent gold debentures guaranteed by the Province of Ontario. Stockholders, however, were required to take over $3,004,700 of the stock of the Niagara, Lockport & Ontario

Power Company, which stock was held by the Ontario Power Company. The Niagara, Lockport & Ontario is the transmission line on the American side of the frontier. In this adjustment each holder of 100 shares of Ontario power stock is required to deposit $2020.42, for which he receives 13.85 shares of first preferred stock of the Niagara, Lockport & Ontario; 9872 shares of second preferred stock and 6325 shares of common stock. Fractional lots were adjusted at the following prices:

First preferred at par; second preferred at $55 a share; common at $14.618 a share. It was announced that a syndicate had been formed to purchase from stockholders their shares in the Niagara, Lockport & Ontario if they desired to dispose of them at the adjustment figure for fractional lots.

Up to the date of this transfer, the main office of the company was at Buffalo, N. Y., the officers being as follows: President, J. J. Albright; vice president, Langdon Albright; secretary-treasurer, Robert C. Board; general manager and chief engineer, V. G. Converse; superintendent, E. D. King. The company supplies power to municipality and various industries at Niagara Falls, Ont., and to territory adjacent to Welland Canal.

PLANS FOR ILLUMINATING ENGINEERING SOCIETY CORRESPONDENCE CONVENTION.

Tentative Program of Papers to Be Published and Discussed by Correspondence.

As already announced, in place of the regular annual convention of the Illuminating Engineering Society this year it is planned to hold a correspondence convention. The Committee on Papers reports the following papers scheduled for inclusion in this convention:

Presidential Address, by W. J. Serrill; report of Committee on Progress, by F. E. Cady, chairman; report of Committee on Nomenclature and Standards, by A. E. Kennelly, chairman; paper on "The Hemisphere as an Integrating Photometer for Projectors, Etc.," by F. A. Benford; a "Color Symposium," conducted as follows: Introductory, by M. Luckiesh, Physics, by H. C. Richards, Psychology, by L. T. Troland, Specifications and Tests, by I. G. Priest, Color in Illumination, by Beatrice Irwin; a paper on "Importance and Value of Illuminating Engineering to Central Stations," by Thos. F. Kelly; "Application of Illuminating Engineering to the Gas Industry," by R. ff. Pierce; "Growth and Present Status of Systems Used in the Maintenance of Gas Lamps in Residences," by E. B. Myers; "Lighting of Independence Square, Philadelphia," by E. F. Kingsbury; "Lighting of Textile Mills," by G. Wrigley; "Economics in the Operation of Large Lighting Installation," by C. L. Law and J. E. Buckley; "Illumination Intensities in Some of the Large Department Stores in New York City," by W. F. Little and J. F. Dick; "Illuminating Engineering Advertising," by G. H. Stickney.

It is planned in a few weeks to arrange these papers in groups for release, respectively during September, October and November, and possibly December of 1917. Early in the month of release, copies will be sent to any one who may apply for them to the general office, and will be accompanied by invitation to submit a written discussion. The boards of managers of sections may, if they wish, utilize such papers for section meetings held in the month of release. In some cases it may be possible to have the papers presented by the authors before such meetings. Local representatives also may, if desired, arrange for meetings in their territory, at which the papers may be presented during the month of release. All discussion of each paper during the month of release, whether delivered at a meeting or submitted in writing to the general office, will be brought together and printed with the paper in the *Transactions* of the Society.

SPECIFICATIONS FOR WIRING MATERIAL ON 3500-TON SHIPS.

Emergency Fleet Corporation Issues Details as to Installations Required.

The Emergency Fleet Corporation of United States Shipping Board, Washington, D. C., under date of July 28, issues Specification No. 127, covering requirements for electric wiring materials for ships of 3500 tons displacements, all being of the commercial marine type, each for a 120-volt, two-wire, direct-current installation. In detail the specifications are as follows:

Item 1. One hundred and eight deck fixtures, steam-tight or vapor-proof, galvanized (or sherardized) iron or brass, with globe and switch, without guard, complete with all necessary fittings.

Item 2. Thirty-seven bulkhead fixtures, steam-tight or vapor-proof, galvanized (or sherardized) iron or brass, with globe, switch and guard, complete with all necessary fittings.

Item 3. One magazine fixtures, same as Item 1, but with globe and guard, and without switch.

Item 4. Three 250-watt fixed unit, non-watertight, without switch, with porcelain-lined metal reflector and guard, complete with outlet box and all necessary fittings and accessories.

Item 5. Ten 250-watt portable units, non-watertight, with porcelain-lined metal reflector, guard and hooked handle, complete with socket and all necessary fittings and accessories, except neither cord nor plug is required.

Item 6. Five 500-watt portable units, otherwise same as Item 5.

Item 7. Twelve desk lamps, non-watertight, with switch and shade, without guard, complete with socket and all necessary fittings and accessories, except neither cord nor plug is required.

Item 8. Twenty 60-watt portable units, otherwise same as Item 5.

Item 9. Two battle lanterns, non-watertight, without switch, with guard, hooked handle and opaque shutter for darkening light, complete with socket and all necessary fittings and accessories, including both cord and plug.

Item 10. One blinker light, water-tight, brass base, rigged construction, complete with socket and all necessary fittings and accessories, including both cord or cable and plug.

Item 11. Two side lights (port and starboard) combination oil and electric, water-tight, brass base, riged construction, regulation size, complete with socket and all necessary fittings and accessories, including both cord or cable and plug.

Item 12. Two anchor lights (fore and aft), combination oil and electric, regulation size, and otherwise as per Item 11.

Item 13. One range light, combination oil and electric, regulation size, and otherwise as per Item 11.

Item 14. One stern light, combination oil and electric, and otherwise as per Item 11.

Item 15. One masthead light, combination oil and electric, regulation size, and otherwise as per Item 11.

Item 16. One 50-ampere snap switch, double-pole, in steam-tight iron or brass box, complete with all fittings and accessories.

Item 17. Ten 5-ampere snap switches, otherwise as per Item 16.

Item 18. Thirteen 5-ampere switch and single-receptacle unit, double-pole, in steam-tight iron or brass box, complete with all fittings and accessories.

Item 19. Thirty-two 5-ampere snap switches and double-receptable unit, otherwise as per Item 18.

Item 20. Twenty-five 5-ampere single receptable, without switch, otherwise as per Item 18.

Item 21. Thirty junction boxes, fused, steam-tight or vapor-proof, iron or brass box, complete with fuses and all necessary accessories, including 100 extra fuses per vessel.

Item 22. Seventy-five branch boxes, unfused, steam-tight, or vapor-proof, iron or brass box, complete with all necessary accessories.

Item 23. Four distribution panels, 6 double-pole fused circuits, non-watertight construction, in iron box with lock, runways for wires, without main switch or fuses, complete with all necessary fittings, lugs, terminals, cartridge fuses (and 50 extra cartridge fuses per panel), number plates, name plates and other appurtenances.

Item 24. Three distribution panels, 8 double-pole fused circuits, and otherwise as per Item 23.

Item 25. One blinker controller, consisting of suitable key with ⅛-inch D. coin-silver contacts, and condenser, all contained in a waterproof iron or brass box designed for mounting upon railing, including all fittings and accessories for operating the blinker lights (Item 10).

Item 26. One telltale board for 3 circuits, with lamps and vibrator to indicate when signal lights are either burning or out, with necessary spare parts.

Item 27. Seventy plugs for portables to fit receptacles of Items 18, 19 and 20, complete, without cord.

Item 28. Thirty-six hooks, iron or brass, designed for mounting on bulkhead to support portables.

Item 29. One connection box, iron or brass, with terminals for interconnecting feed wires, blinker controller, blinker snap switch and blinker light.

Item 30. Seven hundred and fifty clips for ½-inch conduit, either strap iron or malleable casting.

Item 31. One hundred and twenty-five clips for 1-inch conduit, either strap iron or malleable casting.

Item 32. Three thousand feet conduit, ½-inch, galvanized or sherardized, N. E. C. S., with couplings.

Item 33. Five hundred and fifty feet conduit, 1-inch, galvanized or sherardized, N. E. C. S., with couplings.

Item 34. Three thousand five hundred feet wire, duplex, No. 14 B & S gauge, double braid, rubber covered, N. E. C. S.

Item 35. One hundred and fifty feet wire, duplex, No. 12 B & S gauge, double braid, rubber covered, N. E. C. S.

Item 36. One thousand feet wire, single-conductor, No. 6 B & S gauge, double braid, rubber covered, stranded, N. E. C. S.

Item 37. Two hundred and fifty feet wire, single-conductor, No. 2 B & S gauge, double braid, rubber covered, stranded, N. E. C. E.

Item 38. One thousand five hundred feet cotton-braid reinforced No. 14 B & S gauge cord, for all portables, desk lamps, fans, etc., N. E. C. S.

Item 39. One tool box, hard wood with lock and two keys, containing the following: 12 sheets crocus cloth, 12 sheets emery cloth, 12 assorted files, 2 pounds fuse wire (3 amps.), 1 sixteen-ounce ball peen hammer, 1 pair 5-inch diagonal cutting nippers, 2 pair 6-inch combination pliers, 1 pair 10-inch combination pliers, 24 sheets assorted sand paper 2½-inch Champion screw driver, 8-inch Champion screw driver, 1 12-inch Champion screw driver, 1 pointed soldering iron (1 pound), 2 pounds tubular solder, 2 pounds friction tape (¾ inch), 2 pounds rubber insulation tape (¾ inch), 1 Stillson wrench (6 inch), 1 monkey wrench (6 inch), 1 gasoline blow torch (1 pint), 1 hack saw (9 inch), with one dozen blades, 1 wire peeler, 1 electrician scissors (5¼ inch), 1 combination tool set with nine attachments, and 1 wire gauge.

Item 40 Spare parts.

Item 40-a. One set contact points for blinker controller (Item 25).

Item 40-b. Twenty-four gaskets for deck and bulkhead fixtures (Items 1 and 2).

Item 40-c. Six globes for deck and bulkhead fixtures (Items 1 and 2).

Item 40-d. Six guards for portables (Item 8).

Item 40-e. Two guards for portables (Item 5).

Item 40-f. One guard for portable (Item 4).

Item 40-g. Twelve sockets for deck and bulkhead fixtures (Items 1 and 2).

Item 40-h. Two guards for bulkhead fixtures (Item 2).

Item 40-i. Six globes for side lights (Item 11), half red and half green.

Item 40-j. Two globes for anchor lights (Item 12).

Item 40-k. Two globes for range lights (Item 13).

Item 40-l. Two globes for stern lights (Item 14).

Item 40-m. Two globes for masthead light (Item 15).

Item 40-n. Six handles for switches in distribution panels (Items 23 and 24).

All the aforesaid electrical material shall conform strictly to the requirements of the National Board of Fire Underwriters and shall comply with the rules and regulations of the American Bureau of Shipping, and of the United States Steamboat Inspection Service, wherever such rules are applicable. Parts, as far as practicable, shall be interchangeable. Devices are to be the very best in material and workmanship. No lamps are to be furnished.

The manner in which the aforesaid electrical material is to be installed is shown in detail on the attached blue print, 3-V-77L. All proposed devices and wiring material must be perfectly suited to the purposes of the contemplated installation, and particularly must outlet boxes, junction boxes, and other fittings be provided with suitable connections for the particular point of installation.

The material is to be well packed to prevent breakage, and is to be made up so that one or more units may be shipped to any point in the country.

Bidders must submit with their proposal either drawings showing the proposed equipment and material in detail or else a sample of the proposed devices, preferably the latter when not too bulky. Tenders are to be accompanied by complete specifications, characteristics, and performances of the materials and devices proposed, and of the construction employed in the manufacture thereof, so that the corporation may decide in regard to the suitability of the materials which it is purposed to furnish. Bidders are to state the place of manufacture and the point of delivery; and, in event a bidder is not the manufacturer of the devices or material offered, the name of the manufacturer is to be stated in the proposal. Weights, both net and shipping, are to be stated.

EXCELLENT BOOKLET ON THE OPERATION AND CARE OF ELECTRIC VEHICLES.

Co-operative Publication on Standard of Service and Care Prepared by Chicago Electric Vehicle Section.

Much has been written about the care required to secure the best results from electric vehicles, especially regarding their storage batteries. The different makers of these batteries have heretofore, however, been far from agreement on all the details of battery care, which has been confusing alike to owners of electric vehicles, especially of large fleets with mixed equipments, and to electric garage men. It is pleasant to note therefore the excellent results of a co-operative movement undertaken by the Committee on Standards and Garages of the Chicago Electric Vehicle Section of the National Electric Light Association.

This committee consisted of four representatives of as many leading manufacturers of storage batteries, a prominent electric garage man, an electric vehicle manufacturer's representative, and an electric vehicle expert of Chicago's leading central station. The committee met many times and at these round-table gatherings the little differences were finally smoothed out. The result is a 30-page illustrated report published by the Chicago Electric Vehicle Section through the courtesy of the Commonwealth Edison Company.

Eight pages are devoted to simple instructions on both lead and Edison batteries, two pages to daily records, three pages to the attention required in both private and public garages. Several pages describe the central-station service available for electric vehicle users in Chicago, the cost of electric power, rates, capacity of batteries and reading of meters. The free parking service offered by the Chicago Electric Vehicle Section in the downtown circuit is described.

Great Increase in Electric Steel Production in Canada.

The electric furnace steel production has increased in Canada from 61 tons in 1915 to 43,790 tons in 1916. In Montreal alone, according to figures supplied by the Civic Investment & Industrial Company, there are in operation, or being installed, 11 electric furnaces requiring a total of 17,000 horsepower.

NEWS NOTES

Preliminary Training in Telegraphy for the Signal Corps.—Many young men are desirous of serving the country in the Signal Corps. A prerequisite for such service is thorough familiarity with the Morse telegraph code. To meet the needs of such men a preliminary course of instruction on the Morse code and related matters is being organized by at least one technical school, Armour Institute of Technology, 3300 Federal Street, Chicago. Particulars can be obtained by those interested by writing to Dean Raymond or Professor Freeman at the above address.

Jitneys Are Enjoined in Seattle—United States District Judge Neterer has granted the application for a temporary injunction against 179 jitney drivers, asked for by the Puget Sound Traction Light & Power Company, declaring that until they have filed bonds as required by law they have no right to interfere with the rights, franchises, and privileges of the plaintiff. Upon the disclosures made, the court held that there is no authority for operating free busses and that such conduct is clearly an invasion of the company's rights and one which the law will not permit or countenance.

Service Offered Americans on Military Duty in Europe.—Bonbright & Company, Inc., have for distribution a booklet entitled "Ordered Over-Seas," which describes a new fiscal and investment service which they have arranged to place at the disposal of Americans on military or naval duty or other war service in Europe. The facilities of the London and Paris houses of the firm as well as New York office are offered without charge except for actual expenses incurred. The service will include collection of income on securities placed with the firm, collection of interest under income tax requirements, presentation for payment of bonds, transfer of funds, and the like.

Traction Company Buys Coal Mine—The International Traction Company, a subsidiary of United Gas & Electric Company, has bought a coal mine in the Pittsburgh district and will hereafter be able to furnish its New York State railway lines with adequate coal supplies at normal prices. The mine is now running at a capacity of 150,000 tons annually. Of this amount the traction lines will consume about 50,000 tons, leaving the surplus available for sale. Several contracts have been made to take care of the surplus coal at prices which are said to be very favorable to the owners. The mine was taken over on June 1.

United Gas & Electric Engineering Corporation, New York City, closed a contract with the Sheldon Axle & Spring Company, Wilkes-Barre, Pa., for supplying 2100 horsepower for motors, 100 kilowatts for lights and 100 kilowatts for electric welders. Included in this installation is a 300-horsepower synchronous motor-generator set to supply direct current for cranes. Previous to making these electric power installations the latter company had been operating by steam power; but about 600-horsepower boiler capacity will still be utilized for steamhammers and for heating. The former company's 11,000-volt lines will be extended to the Sheldon plant, where 2500-kilovolt-ampere stepdown transformers will be required.

Illuminating Engineering Society Takes War Action.—At the last meeting of the Society's Council it was decided that any member or associate member in good standing when entering the military or naval service of the United States or any of its allies may upon request before October 1, 1917, or if called out after that date, have his name retained upon the membership roll of the Society without payment of dues, during the fiscal year ending September 30, 1918.

Arizona Commission Disapproves Duplication.—The Arizona State Corporation Commission has refused to grant the application of Sanguinetti & Ewing for authority to install a duplicate electric light and power system for Yuma. Light and power is now being obtained from the Yuma Light, Gas and Water Company, which obtains its current from a California hydro electric transmission system. In its ruling the State Corporation Commission says: "A duplication of facilities resulting in unnecessary investments is certain to react against the consumer in the end, for the consuming public must bear the burden of maintaining two institutions where one would suffice."

Officers Iowa Section, N. E. L. A., Will Hold Over.—The executive committee of the Iowa section of the National Electric Light Association met July 6 at Blackhawk Hotel, Davenport, Iowa. R. H. Fowler tendered his resignation as assistant secretary, which was accepted; the work of that office will hereafter be handled by L. E. Caldwell, secretary-treasurer. In view of the fact that the annual convention has been indefinitely postponed, the officers of the association will hold over another year, or until their successors are elected. Present officers are as follows: President, John M. Drabelle, Cedar Rapids; vice president, Herbert Bellamy, Knoxville; secretary-treasurer, L. E. Caldwell, Iowa City. Executive committee comprises E. M. Walker, Dubuque; H. C. Blackwell, Davenport; W. H. Abbott, Omaha; C. Miller, Clermont.

Texas Power Development—The National Hydro-Electric and Conservation Company, Marble Falls, Texas, which is constructing a hydro-electric plant there, recently submitted an offer, through its president, C. H. Alexander, to the city commission of Dallas to supply that city with 20,000 continuous horsepower of electrical energy at 1 cent per kilowatt hour for a period of thirty years. The plant there is about two-thirds finished and will be ready for operation within eighteen months. It will cost approximately $700,000. The construction of the dam across the Colorado River at this place, which is to form the water storage reservoir, was begun several years ago. The company expects to develop about 40,000-horsepower of electrical energy, with distribution to cities and towns within a radius of about 200 miles. The City Commission of Dallas declined to consider an offer at this time, owing to the fact that the plant is not completed, nor ready to fulfill a contract that might be entered into.

New York's Last Horse Car Vanishes.—The Bleeker Street and Fulton Ferry horse-car line ceased operating July 17, after 53 years of service. The last trip over the antiquated line was made on that date, when some of the officials of the New York Railways Company and members of the Public Service Commission were passengers. During 1916 the income from the road was $178, the cost of operating amounting to about $4000. The owners had been maintaining operations to save the franchise.

Notes on Commercial Practice

New-Business Methods, Policies, Rates and Kindred Central Station Matters for the Man Engaged in Selling Electricity

Motors on an Ore Dock Save Expense in Handling.

The Northern Pacific Railway Company owns an ore dock at Superior, Wis., on the Duluth-Superior Harbor. Here iron ore from the Cuyuna Range 100 miles distant is received and loaded into the lake steamers.

The present dock is 600 feet long, 60 feet wide, and contains 100 ore pockets of 350 tons capacity each. To this is now being added an extension exactly doubling the size and capacity of the present dock. The new and old parts are both of concrete.

There are two rows of ore pockets and over each is a double-track railroad. The dump cars from the mines unload directly into the pockets and seven carloads are required to fill a single pocket.

An ore boat can be loaded from each side of the dock at the same time, and this is done by means of steel chutes weighing several tons each. These chutes are raised and lowered by electric power, and their weight makes necessary a large installation of motors, which, of course, are idle the greater part of the time.

Individual hoists are provided for the chutes, controlled by a friction clutch. A 25-horsepower motor is geared to a shaft operating 10 hoists. There are 50 hoists and 10 motors on each side of the old part of the dock, and as many more will be installed on the extension. The illustration herewith shows about half the hoists on one side of the dock. The motors and starting boxes are inclosed in wood housings as shown in the foreground. Current for the installation is bought from the Northern Power Company.

Another Civic Activity of Indianapolis Company Wins Approval.

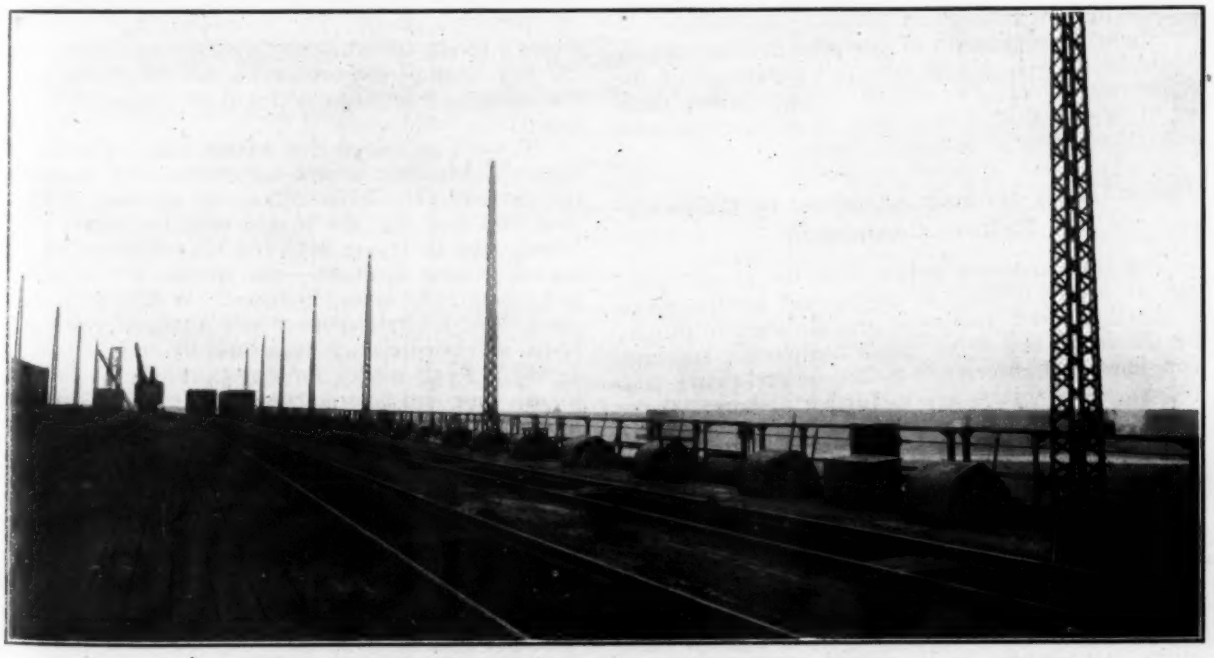
The Merchants Heat & Light Company, of Indianapolis, Ind., has inaugurated another innovation which has gained for it widespread approval. This company has been among the foremost in the country in establishing cordial relations with the public, largely because of its generous participation in civic affairs.

The most recent activity of the company in this direction has been the establishment of a food conservation school, all expense of which is borne by the company.

The appreciation of the public for this sort of activity is well expressed by an editorial published in a recent issue of the *Indiana Forum* from which the following is taken. It may be said that electric ranges and other appliances are, of course, employed in the school.

A real school of "food conservation" begins its third week Monday in the Merchants Heat & Light Company's building, at Washington and Meridian Streets, and it is proving to be one of the war activities of Indianapolis which gives an immediate and a permanent benefit.

The idea of starting a thoroughly practical school of instruction for Indianapolis women, where food conservation could be demonstrated and the application of theories to kitchen problems might be worked out, originated with H. H. Harrison, president of the electric concern, who has been much interested in aiding the many public movements incident to the war.



Ore Dock Showing Battery of Motors (Covered) on Right.

Mr. Harrison believed that his company was in a position to render a real service by establishing a school of instruction open to serious-minded women, and as a result he obtained the services of Mrs. W. J. Marks, an expert in the field of food conservation, for a series of lectures and demonstrations.

A course covering eight weeks was prepared and a class arranged for the morning of each day in the week except Saturday. From 20 to 25 women have registered in each of these classes. The first week of the school was devoted to registration and the general subject of conservation. The second week buying and food valces were considered, and next week canning and drying will be studied. Other weeks of the course will be devoted to care of foods and substitutes, starches, cereals and vegetables; milk, eggs and cheese; meat, selection and substitution; the final week being devoted to fats, utilization and deep frying.

The school is proving one of the most popular and beneficial undertakings incident to lining up the entire family to do its "bit" in the war.

High Price of Fuel Oil May Lead to Higher Electric Power Rates.

Mr. Fleishhacker, president of the Great Western Power Company, San Francisco, is quoted as follows in justification of proposed higher rates for electric power in California:

"An important factor in justifying power companies to increase rates is the scarcity of hydroelectric current in the district around San Francisco Bay, and the present high cost and scarcity of fuel oil. Most of the steam plants, which are still operating in San Francisco and Oakland, will probably cease producing electric power when their contracts for low-priced fuel oil expire. Many of the old oil contracts, a large proportion of which will terminate during the present year, are at prices ranging from 60 to 70 cents per barrel, while the present price of fuel oil delivered at points around San Francisco Bay is about $1.40 per barrel. As fuel oil has offered the principal competition to electric power in California, it can readily be seen that there is no reason why the increased operating cost of all hydroelectric companies should not be more than compensated for through advanced rates.

"Upon the expiration of our present contracts we should be readily able to take full advantage of the higher rates which are justified; in fact, quite a number of new contracts have lately been taken at rates better than those previously in force."

Group Utility Methods Advocated by California Railroad Commission.

The benefits to the public from the group operation of public utilities is emphasized by the action of the Railroad Commission of California in proposing the connection of all important electric transmission lines in California into a comprehensive state system. The objects are to further stabilize service, reduce production and distribution expense and utilize steam flow more effectively by facilitating the interchange of energy. It is stated that nearly 40,000 horsepower can be added to the state's electrical capacity without installing additional generating equipment by the combination of present power sources and higher diversity-factor resulting from interconnected lines. The plan advocated by the California commission in substance parallels the methods of syndicate utility management by specialized organizations.

Iron Campaign Conducted by United Company in New York.

The United Electric Light & Power Company of New York, N. Y., is conducting its annual flatiron campaign during the months of July and August and

THE UNITED ELECTRIC SHOPS'
ANNUAL
July & August
SALE
A Regular $3.50
Electric
Iron at $2.55
"TURNS IRONING DAY INTO IRONING HOUR"
"First Aid" to Summer Comfort: The Electric IRON
Clean, Convenient, Always Ready. May Be Used Wherever There' an Outlet.
Inexpensive to Operate—
2c Pays for an Hour's Ironing.
Saves Miles of Walking.
Saves Time, Labor and Temper.
Makes Hot Kitchens Endurable.
ORDER NOW for immediate or later delivery
THE UNITED ELECTRIC SHOPS
130 East 15th Street — Stuyvesant 4980
99th ST. AT BROADWAY
Phone: Riverside 9401
OPEN UNTIL 10:30 P. M. SATURDAY 1 P. M.
BROADWAY AT 145th ST.
Phone: Audubon 8500
OPEN UNTIL 10:30 P. M. SATURDAY 1 P. M.
ORDER on the Post Card —See Page 16

Iron Advertisement of United Company.

the results already indicate better results than from any previous effort. The accompanying illustration shows a recent advertisement announcing the sale. In the July issue of the company's monthly house organ the following interesting notice of the campaign is published:

"It can't be helped if a certain frigidity exists between the old-time flatiron and her modern successor, the electric. The latter makes for coolness at every step, and now that the heated term has again rolled 'round with its trying days and hot kitchens, the only logical ironing appliance—the electric iron—steps in and masterfully takes command. With this in view, the United Electric shops wisely hit upon a sale of a tested and tried electric iron for July and August, offering a $3.50 model for $2.55. Once all the well known time and labor-saving features of this popular labor-lightener are recalled, little urging will be needed to encourage early ordering. The iron is on sale at each one of the United Electric shops."

New Street-Lighting Contract for Sayre Company.

The Sayre (Pa.) Electric Company has closed a five-year lighting contract with the Borough of South Waverly, Pa., for 35 80-candlepower street lamps. This contract is a renewal of an existing contract and is on the same basis of charge.

New 30-Mile Transmission Line Opens Up New Territory at Reading, Pa.

With the completion of the 33,000-volt transmission line from the Metropolitan Electric Company's West Reading power plant to Lebanon, Pa., the company will have one of the most comprehensive power services in Eastern Pennsylvania, operating in a territory that comprises a rich field for power and lighting customers.

The new line covers a distance of 30 miles, passing through a dozen thriving little towns, some of which are quite important industrial centers. When the new line is finished and power is furnished from the West Reading plant, the present Lebanon power plant will be operated as a substation. This will mean a big reduction in the cost of manufacturing power, which is used in large quantities by the steel mills of that section.

Brooklyn Company's Iron Sales Over 2000 for July.

The Edison Electric Illuminating Company of Brooklyn, N. Y., is holding another iron sale, the results of which far exceeded expectations. T. I. Jones, general sales agent of the company, in reporting the results of this sale to a representative of the ELECTRICAL REVIEW, made the following statement:

"From present indications we are heading for the 2000 mark, which will exceed our June, 1916, record by about 100. When you take into consideration the fact that we have already had a sale this year during the month of March in which we sold 1066, it is very gratifying to know that this second sale of the year will no doubt exceed our single sale of 1916. It is also of interest to note that the 1917 sales are at a price considerably higher than that of 1916."

Fort Smith Company Extends Transmission Lines to New Communities.

The Fort Smith (Ark.) Light & Traction Company has completed a high-tension transmission line to Huntington to supply the Coal District Power Company with electricity. The latter company distributes electricity in the communities of Greenwood, Huntington, Hartford, Mansfield, Booneville and Magazine. The company has also ordered material for an extension of its lines to furnish wholesale power to the Citizens Electric Company, which supplies the electrical requirements of Alma, Mulberry and Ozark.

Texas Company Advertises the Towns It Serves in Its House Organ.

The Texas Power & Light Company serves 105 towns and cities on its lines, these being handled through 21 district offices centrally located with respect to the surrounding towns. The company's slogan, "Service First," is lived up to in every possible way, and no opportunity to make the service better and safer is overlooked.

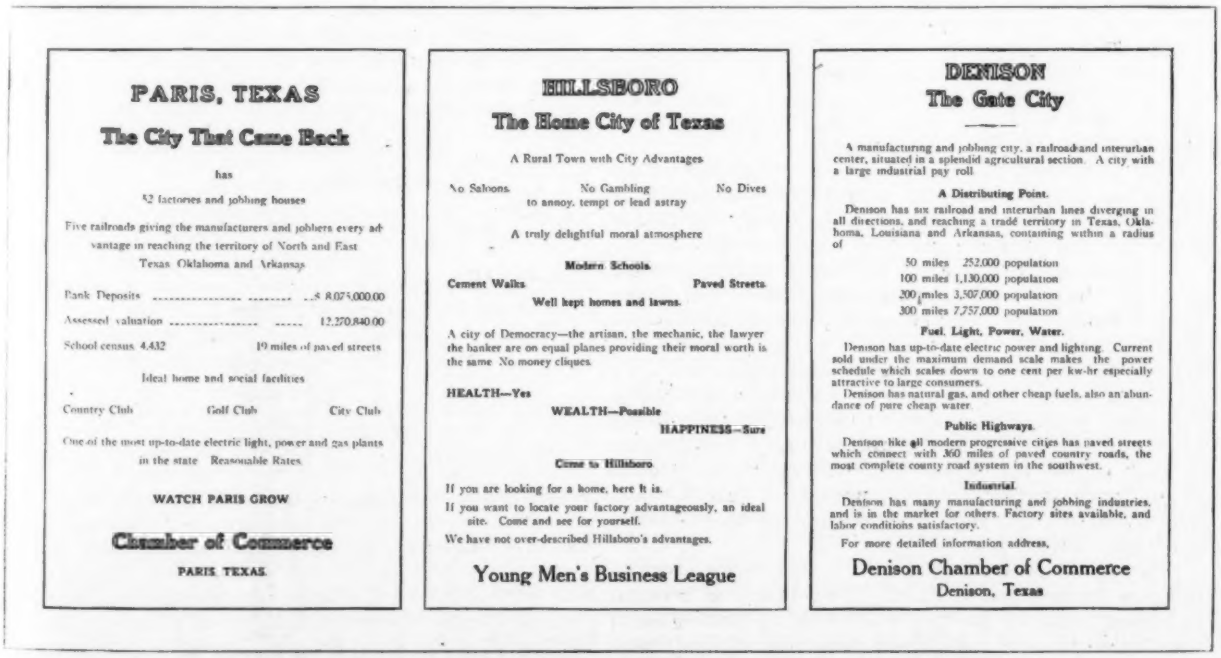
The problem of gaining and maintaining the good will of the thousands of consumers is, as in the case of every public utility, given precedence over everything. One way in which pleasant relations are fostered with the various towns is by giving them publicity in the company's house organ, "Texas Utility News." This publication runs no advertisements of any sort, but the inside front cover of each month's issue is given over to the business organizations of these cities and towns.

This work is handled through the advertising department and the local district managers are requested to have their local business organizations prepare a digest of the city's advantages and virtues and send it in to the main offices. These are received in more or less of a letter form, but are set up to display the prominent features set forth.

No charge is made for this publicity, and each town, in its turn, is afforded the opportunity to proclaim its worthiness through the medium of Texas Utility News to every recipient of this house organ.

Aside from adding an attractive feature to its house organ the Texas Power & Light Company feels that a very material amount of good results from this free will offering.

The accompanying reprints illustrate the sort of display made.



PARIS, TEXAS

The City That Came Back

has

52 factories and jobbing houses

Five railroads giving the manufacturers and jobbers every advantage in reaching the territory of North and East Texas Oklahoma and Arkansas

Bank Deposits ..... $ 8,073,000.00

Assessed valuation 12,270,840.00

School census 4,432 19 miles of paved streets

Ideal home and social facilities

Country Club Golf Club City Club

One of the most up-to-date electric light, power and gas plants in the state Reasonable Rates

WATCH PARIS GROW

Chamber of Commerce

PARIS, TEXAS

HILLSBORO

The Home City of Texas

A Rural Town with City Advantages

No Saloons No Gambling to annoy, tempt or lead astray No Dives

A truly delightful moral atmosphere

Modern Schools

Cement Walks Paved Streets

Well kept homes and lawns.

A city of Democracy—the artisan, the mechanic, the lawyer the banker are on equal planes providing their moral worth is the same No money cliques.

HEALTH—Yes

WEALTH—Possible

HAPPINESS—Sure

Come to Hillsboro

If you are looking for a home, here it is.

If you want to locate your factory advantageously, an ideal site. Come and see for yourself.

We have not over-described Hillsboro's advantages.

Young Men's Business League

DENISON

The Gate City

A manufacturing and jobbing city, a railroad and interurban center, situated in a splendid agricultural section. A city with a large industrial pay roll

A Distributing Point.

Denison has six railroad and interurban lines diverging in all directions, and reaching a trade territory in Texas, Oklahoma, Louisiana and Arkansas, containing within a radius of

50 miles 252,000 population
100 miles 1,130,000 population
200 miles 3,507,000 population
300 miles 7,757,000 population

Fuel, Light, Power, Water.

Denison has up-to-date electric power and lighting. Current sold under the maximum demand scale makes the power schedule which scales down to one cent per kw-hr especially attractive to large consumers.

Denison has natural gas, and other cheap fuels, also an abundance of pure cheap water.

Public Highways.

Denison like all modern progressive cities has paved streets which connect with 360 miles of paved country roads, the most complete county road system in the southwest.

Industrial.

Denison has many manufacturing and jobbing industries, and is in the market for others. Factory sites available, and labor conditions satisfactory.

For more detailed information address,

Denison Chamber of Commerce

Denison, Texas

Three Advertisements Published in Recent Numbers of Texas Bulletin.

Electrical Construction Notes

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

CLEANING DIRTY PORCELAIN INSULATORS.

Process Used Successfully in England Without Deteriorating Dielectric Value.

It does not appear to be generally known that there is in existence a splendid method of restoring serviceable insulators to their former efficiency, after being brought back for overhaul or complete renewal. No matter how blackened they may have become through long exposure in murky surroundings, the treatment hereafter described will bring about a remarkable improvement, without lowering the insulating value of the porcelain, says our contemporary, *Electrical Review*, of London.

A further recommendation lies in the fact that excellent results are obtainable at small cost, and with a minimum of labor. This statement is made after an experience of two years with hundreds of dirty insulators recovered from the most grimy parts of England.

The usual method of restoring a semblance of cleanliness to blackened insulators is to rub the porcelain vigorously with a rag and moistened sand, or to soak them for several days in a barrel of dilute sulphuric acid. Either of these methods gives disappointing results, as may readily be judged if an inspection be carried out after a workman has done his best to make a good job.

In connection with the approved system, it is necessary to provide an iron tank partly filled with water, together with an admixture of quebracho extract (an alkaloid extract from certain South American trees) and caustic soda. Into this tank of liquid are placed the dirty insulators, and a steam jet is applied until the liquid boils. The insulators are then taken out and rinsed in clear water.

An iron tank ½ inch thick and 2 feet square by 18 inches deep, capable of holding 120 insulators, is mounted on wooden supports 2 feet high, so that a workman can perform his duty comfortably.

An ordinary steam pipe without a nozzle is made to enter the tank at a convenient corner, the lower end of which pipe terminates one foot from the top, thus allowing for a space of 6 inches between the end of the steam pipe and the base of the tank.

As soon as it is desired to commence operations this space is filled with water. Quebracho and caustic soda are then added in the proportion of two to one. A tank of the mentioned size will require 3 pounds of quebracho extract and 1½ pounds of caustic soda. The insulators are then inserted and steam is turned on at the valve.

The whole process does not occupy more than 45 minutes from start to finish. The liquid is brought to boiling point by the steam in about 15 minutes, and the insulators are withdrawn from the boiling solution after a period of 10 minutes.

An old pair of blacksmith's tongs is used for recovering the insulators one by one from the tank, and, though this may be regarded as a somewhat crude procedure, mention is made of the fact only to show that no elaborate precautions need be taken. As each insulator is brought out it is thoroughly rinsed in clean water, after which it is placed on a drip board; it is afterward stacked in the storeroom, ready for further service when required.

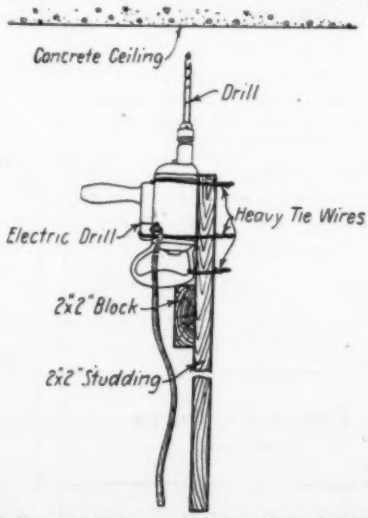
Experience has shown that an ordinary coal fire under the tank does not give such satisfactory results as a steam jet applied as directed. It will be obvious, therefore, that wherever steam is available this process of cleansing telegraph, telephone or power insulators has much to recommend it.

The solution should not be allowed to stand in the tank after the work has been completed, but drained off and placed in a barrel for later use. When needed again the liquid would, of course, require strengthening in the tank with quebracho and caustic soda in the proportion already given.

Extension for Holding Electric Drill.

By T. E. Mullican.

The scheme sketched herewith is designed to show an extension for an electric drill on concrete-ceiling work. Recently I had occasion to install a great amount of conduit work on a concrete ceiling. After rigging up an extension as shown I found it much easier and much safer than standing on a stepladder. I found the idea very effective. Anyone having any considerable amount of drilling to do will find this a great labor-saving scheme, as well as very simple. Care must be exercised in selecting proper timber to stand the strain and yet not be too heavy.



Simple Extension for Holding Electric Drill for Drilling Concrete Ceilings.

Some Uses for the Folding Rule.

By Robert Oster.

The familiar zig-zag rule of four, five or six-foot lengths found in the tool kit of most electricians can be used for several purposes other than that for which it is primarily intended.

Suppose an outlet, light or switch, is to be located in the wall of a complete building. Before cutting an opening in the surface of wall, it is good practice to ascertain if the bay in which the wires are to be run is free of obstructions; for this purpose the rule is very adaptable.

If wires are to be run from top, bore a hole through the top of plate with an eleven-sixteenths-inch standard electrician's bit. Rules are about five-eighths inch wide and can be run through the hole freely. Any cross bridging or other obstruction between plate and above intended outlet can be found by the end of the rule butting against same.

When wires are run from floor to outlet, the bottom plate must be bored, if possible, or baseboard removed. If hole is used, as from basement, rule is inserted and will work through loose plaster or other debris found on top of most bottom plates to obstruction or desired height of outlet.

Should the baseboard be removed, a lath will have to be cut out in surface covered by baseboard. In this opening rule is run up by opening a link after preceding one has been inserted; this is continued to desired height or obstruction.

Emergency Armature Repairs.

By Frank Huskinson.

A very interesting emergency repair job on an armature was successfully made by the writer on a 50-horsepower direct-current motor. The armature showed a ground and would not run. Upon testing it out, it was found that one of the commutator bars was grounded to the armature core in an inaccessible place. There was no extra armature ready to use on this motor and, as a delay of even a few minutes was costly, it was necessary to repair it in some way and get it into running order as soon as possible.

The wires were removed from the grounded commutator bar and this bar was very carefully hammered down until it was about 1/32 inch or more lower than the other commutator bars. Then this grounded bar was given a coat of water-glass and as soon as this was dry the motor was started up and gave perfect satisfaction for several months when the armature was removed and another one put in. The old one was still in good condition.

This is an emergency repair job that should interest any one in electrical operating and maintenance work; the chances are that it never has been done before, at least to my knowledge.

Making Odd Crossarms Quickly in Small Lots.

By Arthur S. Nickerson.

Quite often around an industrial plant there is need for crossarms of varying lengths and spacing between pins. It is rather expensive to carry an assortment of different sizes of crossarms, and if each one were to be made up specially it would be both slow and expensive. I believe that the following will cut both the time and expense: Have a stick (or a number of them) of the proper width and thickness finished up and painted. Have it any convenient length, say 10, 12 or more feet. When you desire a crossarm with two or three pins, just saw it off, bore it, insert the pins and the job is done. Pins made of iron bolts with a wooden thimble are most convenient and I think better, because of the small hole necessary in the crossarm.

Useful Wiring Hints.

Locknut for Emergency Use.—It is often necessary in conduit work to use a locknut when none is at hand. To avoid waste of time in going back to the shop, I have used the following emergency locknut in such cases: Take a coupling of the right size and cut off from it with the hacksaw a piece one-fourth to three-eighths inch long, which will be found to serve very well. James Burns.

Cleaning Hands After Soldering.—In working continually at soldering jobs, the hands become more or less covered with the soldering acid, which it is almost impossible to remove with ordinary soap, since this slips over the acid, leaving the hands in a stained and sticky condition. Rubbing the hands with machine oil and then rubbing them briskly with dry sawdust loosens the acid, which then may be removed by washing in warm water. H. B. Stillman.

Tool for Reaming Holes in Semi-Indirect Glass Bowls.—A handy tool in a fixture hanger's tool bag is a three-eighths-inch round tapered file with a three-eighths to one-eighth-inch taper. A number of the glass bowls come to the fixture man with rough-edged holes for the chain hangers and socket supports. With one three-eighths-inch file the hole can be filed smooth and reamed out so as to admit the different kinds of supporting attachments. M. J. Moriarty.

To Soften Cast-Iron Outlet Boxes.—To ream or drill holes in cast-iron outlet boxes and fittings is sometimes a difficult task on account of the extra hardness of the metal. Whenever I have a job of this kind to do on boxes where the metal is extra hard I heat the box to a high temperature in a forge and then cover it over with fine coal dust and let it cool gradually. When the box has cooled it can be drilled or reamed as easily as the ordinary soft cast iron, being now practically annealed iron. M. J. Moriarty.

Among the Contractors.

The Home Electric Company, of Paducah, Ky., has occupied a new store to accommodate its increased business. It has obtained the Western Kentucky and Southern Illinois agency for the Delco farm-lighting equipment and has also added automobile tires and accessories to its business. The concern is owned by Roy Katterjohn and C. B. Smiley.

The James Supply Company, of Chattanooga, Tenn., has been awarded the contract for installation of the lighting fixtures on the new Market Street bridge in that city. The price was $3,933.68 and provides for 28 bronze light posts, each to be topped with a globe. Two cluster pylons, in addition, will be erected at each end of the bridge.

Gray & Barash Company, electrical engineers and contractors, Seattle, Wash., has leased a site at Horton Avenue and Colorado Street, covering an entire block in the south canal waterway addition, and will erect a plant covering all this space. The present extraordinary demand for electrical machinery for the many new ships that are being constructed has led to this move.

The Dealer and Storekeeper

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Appliances

SELLING WASHING MACHINES TO MEN IN KANSAS CITY.

B-R Electric Company Disposing of Carload of Machines Every Month by Adopting New Methods.

The B-R Electric Company is "selling" electric washing machines to the men of Kansas City—the husbands bringing in their wives to complete the transaction by the application of the name to the dotted line. As a result of the retailing campaign now in progress, the company has placed an order for a carload every 30 days, which amount may be increased—and probably will—as the campaign gets in its work, and the news spreads of this labor-saver being available.

The company is going direct to the households with the device, through a corps of salesmen; but it is also aiming to awaken the men of Kansas City to the chance of relieving the home burdens. The experience of the past few weeks proves that men are appealed to, by the suggestion that here is a means of cutting down household burdens.

The campaign began with a display of the washing machines in the company's conspicuous windows, at Fifteenth and Walnut Streets. The building is outside the downtown retail district; and the corner is not even a busy transfer point. Comparatively few people walk by the store. But many pass on the street cars —and these saw the displays.

Machines Are Demonstrated on Sidewalk.

A few sales were made as a result of the window exhibition in which the old back-breaking method was contrasted with the electrical and easy way. But when a machine, with the lid off, the white suds foaming up as the cylinder revolved in the soapy water, was placed out on the sidewalk, the big returns began to come.

The preliminary test of the plan proved another estimate of Mr. Armstrong: that every customer can be depended on to sell an average of four machines. A woman with a washing machine is more enthusiastic over her find, than a mere man can imagine. She is a regular newsaper, spreading the light abroad.

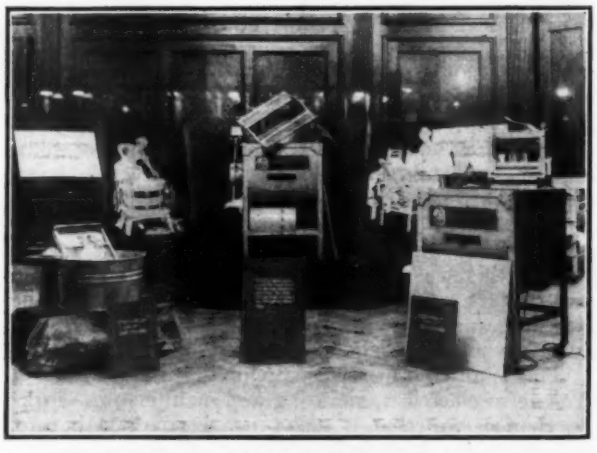
As many as two machines a day were sold by this plan from the comparatively isolated retail store of the B-R Company. As many as fourteen leads were secured in two hours.

Literature Distributed.

While the selling plan was in progress at the store, and a few weeks before that, literature had been mailed or distributed to a large list, telling of washing machines. Chiefly the literature was leaflets, including the folder of the washing-machine company which features a sour-visaged man doing the family washing the old-fashioned way. Apparently the picture got the men to thinking about the washing; this was believed to have been one reason for the interest shown in the display by passing men.

In July, the plan was expanded. Six washing machines were set up on the sidewalk, at six strategic points in Kansas City, Mo., and Kansas City, Kansas. In a few cases, the machines were placed in front of stores, electrical or furniture, that might logically be expected to handle such items. But this feature was not essential. One was in front of a confectionery store. Another near a dry goods store—another blocked the window of a cleaner and dyer. In each case the proprietor of the store provided a person to look after prospects. Usually it was the proprietor himself—the stores were small, suburban ones. A small commission was given for the names of prospects, secured from among the people who stopped to watch the machine work; a larger commission was given for sales. In some cases, the wives of the proprietors attended to the demonstration, and proved efficient sales assistants. The wives of some salesmen also helped.

An efficient salesman from the company's force was, however, assigned to each display. For the first few days he spent most of his time canvassing the neighborhood, talking the goods, and inviting women to see the demonstration. He frequently accompanied them to the display. Very shortly, however, each salesman had nearly enough prospects in hand to keep him busy. Each spent two or three hours a day at the



Window Display of the B-R Electric Company.

demonstration, during the periods when the number of people passing was the largest, at noon and at evening.

The demonstrations were located, as mentioned, at strategic points; though not always at transfer corners.

The company intensified its advertising in the districts where the demonstrations were staged. Besides the literature distributed by the salesmen, advertising was also spread by a company of boy scouts, calling attention to the opportunity to see a machine in action.

What Shall Policy be in War Time?

Why a Leading Electrical Firm Has Steadily Advertised, Though Oversold During the Past Two Years

By C. H. CLARK

Robbins & Myers Company, Springfield, Ohio.

DURING the past two years the demand for Robbins & Myers motors has been such that the company has been compelled to refuse enormous quantities of business from new prospects. This condition has not caused the company to curtail the annual investment for advertising. On the contrary, the appropriation has been increased during this period in line with the growth of the business, just as it has during periods of normal demand.

We were asked for a statement on the policy which has led us to adopt this course. In a broad way this statement can be made by saying that we do not look upon our advertising policy as something to be settled each year as a part of that year's operations only. Instead, we look upon the advertising we do each year as a stone in the foundation of the permanent business structure we are building. In addition to the service this advertising performs today, it will be lending support to the advertising which will be done in future years.

Advertising Planned as Systematically as Shop Buildings.

We consider the advertising expenditure as one of the permanent investments, such as the expenditure for factory buildings and other permanent assets of a more tangible nature than the good will advertising helps to build. The buildings we erect this year are not planned to provide for this year's production only, but to provide for the production of future years as well. Neither are they designed to meet conditions which suddenly arise this year. They are built according to plans which were formulated long before the actual need of them arose, and they are arranged not only to fit in with existing plant construction but also to harmonize with the plant we expect to have in the future.

The same method is followed in our advertising. We are building according to our vision of the future business of the company. The plan is too broad to permit of serious interruptions in its perfection because of abnormal conditions which might arise during any one or two years.

Advertising is Good-Will Insurance.

Continuous advertising is good-will insurance. In order that this insurance may not be allowed to lapse during some future period when business conditions are below normal and earnings may be too scant to provide a sufficient advertising fund, we are building up a reserve advertising fund. If this is worth while, and the writer believes in it as thoroughly as he believes in advertising, then it would certainly be folly to allow our good-will insurance to lapse at a time when we are making money enough to pay the premiums without missing it.

If the advertising we do were not a good-will investment; if the purpose of it were to get inquiries which we could turn into immediate business and nothing else, then I can see where it might be advisable to reduce this advertising during times like the present, when the demand for our product is far greater than our ability to produce.

As a matter of fact, though, if this were the purpose of such advertising, we would have discontinued it long ago, for it could not possibly show a profit if measured by this standard. This is obvious when you consider that out of the millions of circulation we buy, but a few thousand represent people who are possible prospects for the sale of a motor, either direct from us or through a dealer. That this is true is due to the fact that a very large percentage of our motors are not used by the general public as motors, but as an important part of the electric-driven household devices, office appliances, store equipment and factory machines used by the general public.

We cannot sell motors for the majority of these devices except to the manufacturers of the machines, as they are a built-in part of the machines in most instances. Consequently there would be nothing gained by soliciting inquiries from the general public in our advertising. The purpose of the advertising is rather to familiarize users of such machines with the fact that the motor is a very vital part of the machine, the part which determines its reliability and efficiency, and also to acquaint them with Robbins & Myers motors and their reliability.

How It Works Out Indirectly but Effectively.

Advertising such as this induces the user to investigate the motor when buying a motor-equipped device and makes the machine which is equipped with a Robbins & Myers motor more salable than one which is equipped with an unknown motor. A tendency such as this on the part of the consumer soon becomes apparent to the dealer and influences him in the selection of motor-driven machines, and the dealer preference will in turn react upon the manufacturer.

That the proposition works out in this way is shown clearly by the fact that, with a very few exceptions, the manufacturers who use our motors keep the Robbins & Myers nameplate on the motor when it is built into their machines. As this nameplate is very easily removable, the obvious conclusion is that it is a sales help for the machine to show that the motor is made by the Robbins & Myers Company and not by the manufacturer of the machine.

When advertising must work in the roundabout route I have described, inquiries could not be used as a fair index of the value of the advertising. This does not mean, though, that we do not have conclusive evidence that our advertising is profitable, for it has shown its influence very vividly in our sales curve.

Sales Impetus from Advertising.

The Robbins & Myers Company has been manufacturing electric motors and fans almost from the very beginning of the industry. Until about nine years

ago its advertising had been confined to the electrical trade and the manufacturers who bought motors for their product. During this period the business of the company showed a very even rate of growth and one which was not large during any one year. Within a year after the advertising to the general public was started the business began to show a phenomenal increase, and during the second year of this advertising the increase in business for the year was as great as it had been during any three years which preceded it. And the sales curve has never shown a tendency to depart from the direction it took at that time, throughout the years which have followed since the company became an advertiser in mediums reaching the general public.

I feel that there must be many advertisers who have had very similar experiences. I know many of them take an attitude similar to our present one toward the advertising investment. I know of others who have taken the other attitude and have questioned the advisability of going ahead with their advertising at the present time, for I have heard advertising managers complain about the shortsightedness of directors who are adopting this attitude.

In some cases where this attitude is taken, I wonder if the fault isn't partly with the advertising man. His whole time is devoted to advertising problems. He has a very vivid mental picture of just what the advertising has done for his company. It is all so clear to him that he cannot realize that his officers and directors, with their many interests and widely varying branches of the business to look after, have not absorbed the advertising idea as he has absorbed it. He discusses the advertising with his directors and officers as he would discuss it with another advertising man and they fail to get the basic ideas. I believe this is true in many cases, and I feel sure if the advertising man would use the same ingenuity in selling his directors on the value of their advertising that he uses in selling goods with the advertising, there would not be so many complaints heard from advertising men about the attitude of boards of directors.

The writer was connected with a company at one time where he had to meet this condition. The directors of the company he was connected with were thoroughly sold on the value of advertising, and knew in a general way what it had accomplished for the company. The officers of the company had always been satisfied to leave the advertising plan entirely up to the advertising manager, however, and had not made as close a study of advertising as they had of other departments of the business. From their sales chart they knew it brought results and was profitable, but they hadn't given much thought as to just how it operated in their particular business. They felt as many do, that it was a current expenditure and that the results were largely in the nature of immediate returns. A heavily sold condition arose and the directors called upon me with the suggestion that we might just as well discontinue our general advertising until conditions were such that the factory could meet the demand upon it.

Proving the Value of Continued Advertising.

In answer to their suggestion, I showed them graphically by a chart compiled from our sales and advertising records for a period of several years just what had been accomplished by the advertising. They knew about these results in a general way, but the chart gave them a much clearer vision of these results than they had ever had before. It practically removed the element of faith from the evidence upon which their opinion of advertising had been founded.

Then I totaled up what had been expended for advertising for a period of ten years back and showed them that the investment in advertising during this period was greater than the money invested in the factory buildings. I showed them that this money was not money we had expended and received all of our returns on, but that it represented a permanent investment in the good will it had helped us build, a good will which was largely responsible for the enormous increase in the assets represented by the factory buildings.

I used the argument that they wouldn't for a minute think of discontinuing the fire insurance on the factory buildings, but they were thinking of doing a very similar thing by discontinuing the insurance on their good will, an asset which was worth a great deal more than their factory buildings. I pointed out the fact that the risk would be greater in the case of the good-will insurance than it would with the building insurance. The chances were strongly in favor of the company that a disastrous fire would not occur with the fireproof construction of their buildings and the elaborate systems of fire protection they had installed, while it was almost certain that the good-will advertising had built would be greatly damaged by a lapse in the advertising. I pointed out, too, the fact that experience has shown that it would cost more to get our advertising campaign back to its old momentum when we were ready to advertise again than the money we would save during the time the advertising was discontinued.

The argument was effective, and to me it answers the whole question in regard to advertising either during times when the factory cannot keep up with orders or during times when there is little business available. If advertising does build good will, if there is anything in the cumulative value of advertising, then we simply can't afford to advertise spasmodically. We should plan our advertising with the idea of sticking to it through prosperous years and lean years, without pause, or we should leave it out of our sales plan entirely.

Special Hotpoint Publicity Campaign in Behalf of Local Dealers of Heating Appliances.

In its dealer sales helps the Hotpoint Electric Heating Company, of Ontario, Cal., Chicago and New York, has been one of the most generous manufacturers. To its liberal use of the advertising pages of the best known national magazines is due no small part of the popularity of electric tableware and other cooking and heating devices in general and, of course, the widespread use of Hotpoint appliances in particular. The company prides itself on being the largest exclusive manufacturer of electric household appliances.

In carrying on the plan of dealer helps the company has mapped out considerable national advertising during the latter half of the year which disclosed in advance to local dealers in a large portfolio now being sent out. It shows full-size reproductions of five big "ads" that it is expected will be read by nearly 40,000,000 readers and which should therefore create an extraordinary demand for the Hotpoint appliances to be featured. The portfolio also contains reproductions of much Hotpoint co-operative material available for use by dealers in making window displays, demonstrations and the like.

New Electrical Appliances

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

New General Electric Standardized Bus Supports.

Standardized busbar, buswire and bustube supports to meet a wide range of requirements are illustrated in the accompanying group cut. The insulators are divided into two classes—one for use up to 3500 volts and the other from that up to 16,500 volts. The only difference is in the two sizes of insulators to meet different voltage requirements.

Interchangeable iron caps are fastened permanently to each end of the insulators. Then to the cap which is to form the top of the insulator are fastened various supporting fittings as shown on which buswires, bustubes, or busbars are mounted.

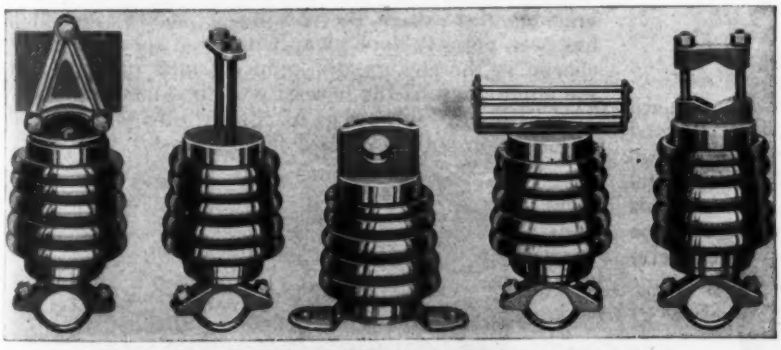
To the lower cap one of three different fittings, for supporting respectively on ¾ or 1¼-inch pipe, or flat surface is fastened by two bolts. The construction of each fitting fastened to the bottom of the insulator is such that the insulator can be turned through an arc of 90 degrees parallel to its base and locked in any desired position by the holding bolts.

The support on the left is used for buses on edge which must be clamped in place. This support is used also in bus compartments when provided with a fitting for flat-surface mounting. One part of the busclamp is bolted to the insulator cap, the other part of the clamp to the first part.

The next support is used for buses on edge when it is desired to hold the bars in place against vertical movement or when in bus compartments it is necessary to use a stay insulator and sectionalizing switches. The link across the top of the upright pins will hold the bus in place vertically and horizontally.

When there is no need of guard against vertical movement of the bars, the uprights, nuts, and cross link shown are omitted and in their place are used two uprights threaded only on the lower ends.

The third support is used for round buses, either tube or solid. This support can be mounted upright, horizontally or in an inverted position. Bare conductor is generally used with the support. This support is built for buses of three different diameters: ¾, 15/16, and 1-5/16 inches.



Group of General Electric Standardized Bus Supports.

The fourth support from the left is used when buses are placed on the side. The number of horizontal cross pieces used with this type of support will depend upon the number of busbars it is desired to support.

The support on the right is made in two sizes, one for supporting 1¼ and the other for 1⅝-inch buswire. This support can be mounted upright, horizontally or inverted. It is often used for wiring around the station. The upper part is made of two fiber parts which are held in place by bolts running through the fiber into the insulator cap. The wire for use with this support is insulated usually.

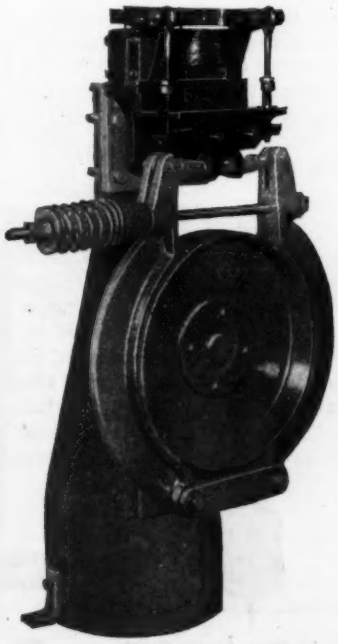
Various other styles of top fittings are available, but the above description will serve to indicate in a general way the extent of this particular line.

Ventilation is obtained by spaces between the bus lamination. When these spaces are not provided by the connection bars from breakers or switches, spacers are inserted between the bus laminations.

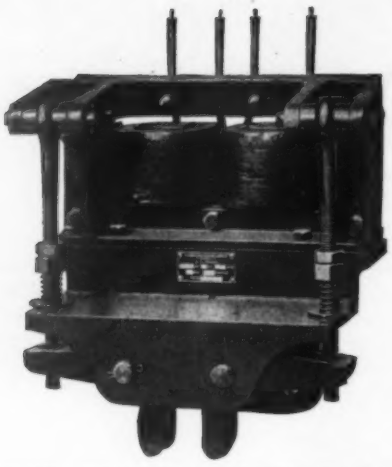
These bus supports are manufactured by the General Electric Company, Schenectady, N. Y.

Westinghouse Elevator Brake Magnet.

In general, elevators operating on alternating current are entirely dependent upon a friction braking mechanism for obtaining smooth and accurate stops. Failure of the brake may result in injury to passengers and damage to property. Such failure may be successfully guarded against by equipping the brake with



Brake Magnet in Service.



Alternating-Current Magnet for Elevator Brake.

a magnet. To meet such requirements, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is marketing the brake magnet shown, which assures safe, positive, and quiet action of the brake. All chatter and magnetic hum have been eliminated and immersion in oil is unnecessary.

This magnet is designed for use with the parts regularly furnished by the elevator builder, and may be used for elevator motors operating on 220, 440 and 550-volt, 25 to 60-cycle, two-phase and three-phase circuits. The complete magnet is compact, durable and very light, weighing only 70 pounds. It is installed by mounting directly over the brake wheel, the base being bolted against the machined gear case.

The operation of the magnet is as follows: When no current is flowing through the motor, the brakes are set, being held by a spring. When the motor is started, a portion of the current passes through the shunt magnet coils, energizing them and pulling down the brake armature. The travel of this armature, which is about ¼ inch at the point farthest from the bearing, gives a horizontal motion of 1-16 inch to each of the lower ends of the bell-cranks, compressing the springs and releasing the brake. When the current fails or is cut off, the armature is released and the brake is applied by the springs. The recoil of the magnet armature is taken up by buffer springs, which may be adjusted to the proper compression. The pull of the magnet is 150 pounds on the lower ends of each of the bell-cranks, making a total of 300 pounds compression available.

New and Improved Wall Brackets.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 4, 1916, was described a line of wall brackets that has met with generous reception since it was placed on the market. The National Metal Molding Company, Pittsburgh, Pa., has added to this line of wall brackets a new single-point screw-type bracket, known as No. 5011, which is illustrated herewith. The insulator on this bracket is of the same design as on other National brackets; the necessity of using tie wires has been entirely eliminated, as it is intended that the wires be threaded through the "iron-bound" insulators, which are very similar in construction to strain insulators. The design of the insulators, however, is such that tie wires may be used when desired.

Fig. 1.—New Single-Point Bracket.

Fig. 2.—Strap Plate.

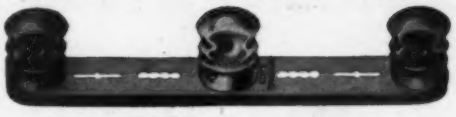


Fig. 3.—Improved Three-Point Bracket.

The bracket shown, the manufacturer claims, is especially adaptable for supporting wires to wood surfaces. A two-inch No. 20 wood screw is firmly attached to the sherardized base, in such a manner as to eliminate entirely the possibility of its turning or pulling loose. The bracket is not only exceedingly rugged in construction but also neat in appearance.

The company has also made some slight changes in the design of its No. 5003 three-point bracket which still further enhance the universal application of these National brackets. Through the provision of slots, as illustrated, and similar slots in straps No. 5040, in connection with bolts, this bracket may be used as either a two or three-point breakarm. The slots allow for the varying sizes of crossarms, or for the application of the brackets in either a vertical or horizontal position, as illustrated in Figs. 4 and 5.

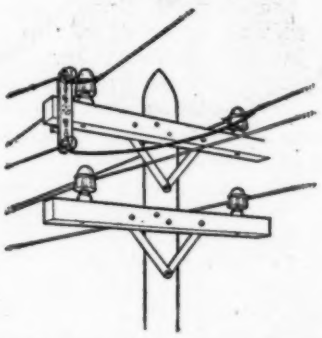


Fig. 4.—Using Two-Point Bracket as Vertical Breakarm.

With a stock of one, two and three-point brackets, corner chairs, breakarm straps and bolts, it is claimed that practically any service connection can be made, that the necessity of carrying a large variety of special brackets, for which there is but occasional demand, has been entirely done away with; that the investment charge is thereby greatly reduced, and further, that the elimination of the necessity of tie wires, especially at the present high prices of copper, effects a marked reduction in both labor and material costs.

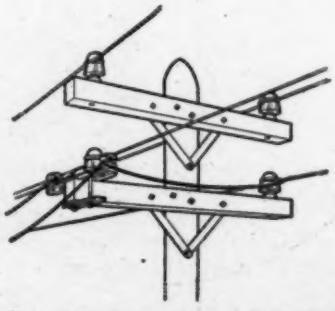


Fig. 5.—Using Two-Point Bracket as Horizontal Breakarm.

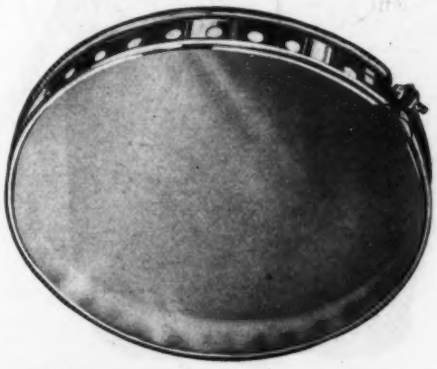
New Lighting Specialties for Show-Case and Desk Use.

A number of new electric lighting specialties have been placed on the market by the F. H. Trimble Manufacturing Company, Inc., Los Angeles, Cal. These

Combined Show-Case Light and Display Stand.

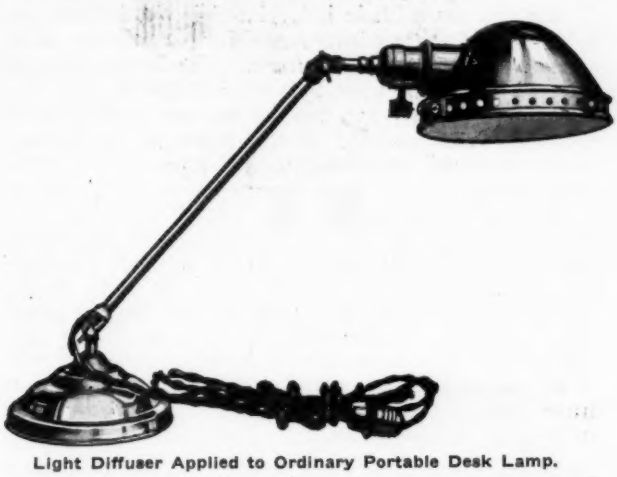
are illustrated herewith. The first is a combined show-case lamp and display stand. This device is a portable one and consists of three distinct parts, the first being a nickel-finished reflector bowl, 10 inches in diameter, and containing a 75-watt gas-filled tungsten lamp or similar unit. Directly above this is a plate-glass shelf, which is furnished either as a circle 16 inches in diameter, or as a square 14 inches on the side. Above this is an upright carrying a card rack 5 by 9 inches in size in which may be placed price cards or other suitable display matter.

This device is entirely portable and is connected by means of a good cord to any convenient lighting outlet. The reflector bowl is open on the bottom, of course, so that when placed over any portion of a glass show-case the light from the lamp floods the interior of the case, illuminating the goods on display very effectively. The glass shelf over the reflector can be used for displaying small articles and the card rack at the top can be used for price cards or other suitable cards to attract attention.



Light Diffuser for Use on Portables.

The second illustration shows a light diffuser which, as shown in the third illustration, can be readily applied to the opening of the reflector commonly used for desk lamps of the portable type. Ordinarily such lamps cause considerable glare, especially if a person working at the desk is required to write upon or read from glazed paper or other highly polished surfaces; in this case the surfaces act like a mirror to reflect the light from the lamp directly into the eye, causing much

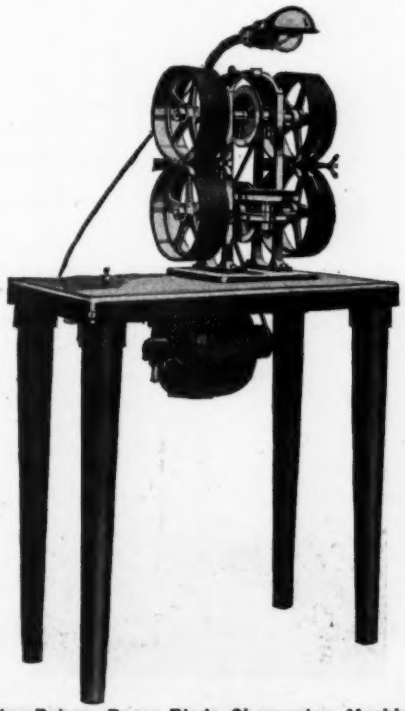


Light Diffuser Applied to Ordinary Portable Desk Lamp.

discomfort as well as lowering the efficiency of vision. The diffuser illustrated is made to overcome these difficulties. It is easily attached to any ordinary metal shade, and can be readily detached for cleaning or lamp renewal. It is furnished in brushed brass. This device is highly recommended by eye specialists. Patents for both devices illustrated have been applied for.

Electrically Operated Razor-Blade Sharpener.

The razor-blade sharpener made by the A. E. Hill Manufacturing Company, Atlanta, Ga., sharpens the blade on the same principle that has always been



Motor-Driven Razor-Blade Sharpening Machine.

used in sharpening the old-style razor by hand. The only difference is that with this machine the hone and strops are rotated instead of moving the razor over them.

The hone is in the form of a flat disk, which rotates in a horizontal plane, and the strops are mounted on wheels which run in vertical planes. A special holder is provided for the blades which will hold every style of blade.

To sharpen a blade it is placed in the holder and held against the rotating hone for an instant, each side being applied to the hone. The holder is then inserted in a slot provided for it between the two sharpening wheels and rocked up and down so as to apply first one side of the blade to the bottom wheel, then the other side to the upper wheel. The same operation is then performed with the finishing wheel. The sharpening wheels are made of perforated coarse-grained leather, the perforations being filled with a honing compound which feeds out over the strops and keeps them in condition. The finishing wheels are covered with the finest grade of horse hide which has been "broke-in" on a special machine.

The construction of the machine and holder is such that it is impossible to apply the blades to the hone or strops at anything except the correct sharpening angle. It is claimed that any boy or girl can operate it and get the same results as an expert.

A lamp bracket is mounted on the head of the machine so as to throw a good light directly upon the work. The stropping wheels and hone are belt-driven from a 1/10-horsepower Robbins & Myers motor.

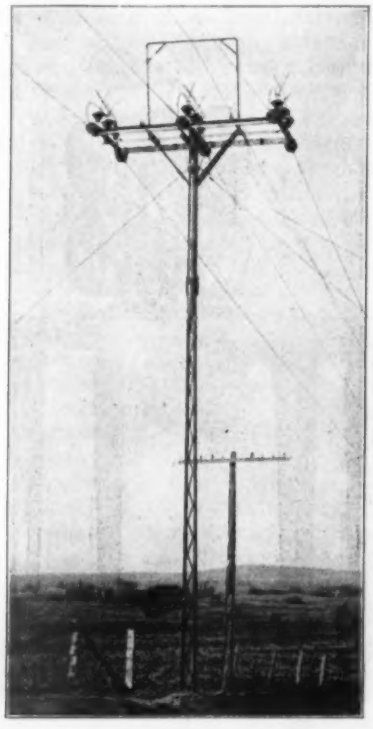
Sectionalizing Line Switch with Overhead Ground-Wire Fittings.

The accompanying illustration shows a method employed by the Delta-Star Electric Company, Chicago, Ill., for mounting its standard three-pole type PM 33,000-volt, 200-ampere, air-break switch on a Bates expanded-steel transmission pole.

To enable carrying an overhead ground wire straight through the line, the crossarms are provided with an auxiliary rack to which is fastened the overhead ground wire.

The switch is provided with a manually operated remote-control interlocked mechanism enabling all three poles to be simultaneously opened or closed by means of a locking-type handle. When desired, the operating shaft can be extended so that the switch handle is near ground level.

The complete switching, crossarm and pole equipment is shipped ready for immediate assembly, thus materially reducing installation cost.



Outdoor Line Switch for 33,000 Volts with Ground Wire Fittings.

Packard Polyphase Metering Transformers.

About a year ago there was perfected and placed on the market a line of single-phase weatherproof metering transformers combining the current and potential elements which are mounted in one oil-filled case. These are made by the Packard Electric Company, Warren, Ohio. The favor which these transformers met at the hands of the operating companies has convinced the company that a similar line specially made for metering polyphase current at the higher voltages would fill a long needed want.

The accompanying illustrations, Figs. 1 and 2, show the new polyphase unit. This is adapted to two phase, three or four-wire; also three-phase, three or four-wire. The two-phase set contains two current and two potential elements. The three-phase, three-wire set is similar to the two-phase unit. The three-phase, four-wire set contains three current and two potential elements. These current and potential elements are interconnected and properly phased out, which makes the polyphase meter installation as simple as the single-phase one.

The low-voltage terminals of the potential elements are porcelain-bushed and carried through one of the pockets of the case, as shown in Fig. 1, in a three-conductor flexible cable that is coded red, green and black. The secondaries of the current elements are carried through the case in a similar manner. These secondary cables are furnished eight feet long on standard metering sets, which permits of mount-

Fig. 1.—Polyphase Weatherproof Type of Metering Transformer.

Fig. 2.—Active Element of a Polyphase Metering Transformer Set.

ing the meter at a substantial and safe distance from the high-tension lines.

The high-tension terminals are carried through the case as shown in the middle of Fig. 1. The current transformers are double-wound, giving a double ratio of transformation which provides for 100 per cent

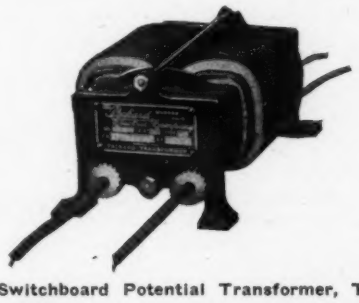


Fig. 3.—Switchboard Potential Transformer, Type SB.

future growth, thus eliminating the necessity of changing metering equipment as additional load is added. Fig. 2 shows the active element of a polyphase set.

This line is now completed for single, two and three-phase service for operating voltages up to and including 16,500 volts, and maximum line currents of 100 amperes. Satisfactory equipment for metering current furnished to small towns and sparsely settled districts is thus now assured the central station. These

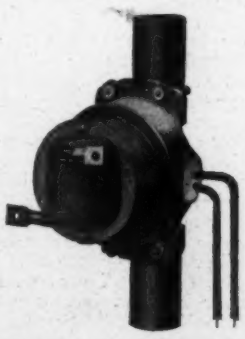


Fig. 4.—Switchboard Current Transformer, Type K.

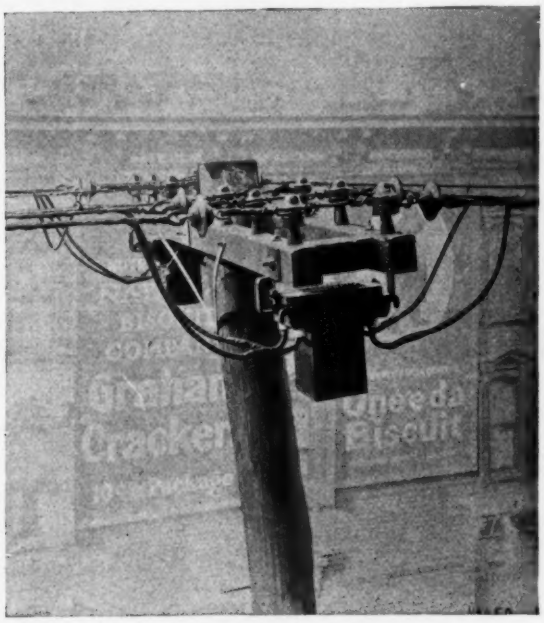
metering sets are equipped with hanger irons which permit of mounting on crossarms or outdoor substations.

Switchboard types have also been developed. Of the potential transformers, type SB (Fig. 3) is dry-insulated and furnished for a maximum volting of 4,400, and type SO is oil-insulated for a maximum voltage of 22,000; the capacity ratings are 50, 100 and 200 volt-amperes.

The switchboard current transformers, type K (Fig. 4) are dry-insulated and are furnished for a maximum voltage of 6,600 volts, and any standard ratio up to 250-5 amperes; the capacity is 50 volt-amperes.

Compact Line-Sectionalizing Breaker.

Pole-mounting, non-automatic, oil circuit-breakers have been supplied by the Westinghouse Electric & Manufacturing Company based upon an ingenious plea suggested by the Edison Electric Illuminating Company, of Brooklyn. Galvanized-iron straps are bent and drilled so as to be attached by one bolt to the crossarm and by the cover-clamping bolt of the type



Compact Oil Circuit-Breaker Mounted on Pole.

D non-automatic oil circuit-breaker, longer bolts than standard being used in this latter case.

The accompanying illustration shows two of these breakers installed on Brooklyn Edison lines, the 4,500-volt two-phase wires being dead-ended on strain insulators tied together and supported by pin insulators. Due to these breakers having a straight-line arrangement of current-carrying parts, a particularly neat-looking installation can be made.

Continued Advertising as a Merchandising Policy.

On another page we print an article by C. H. Clark, originally prepared for *Printers' Ink*, which is so suggestive of the proper policy to be pursued at this time in electrical merchandising publicity that we particularly commend it to the attention of our readers. Its application can be made just as certainly to local or sectional campaigns as to those of a broad national character.

Activities in the Trade

The Phillips Insulated Wire Company, Pawtucket, R. I., announces a change in its corporate name. The business will now be conducted under the name of Phillips Wire Company, otherwise there are no changes, the location, policy and management remaining as heretofore.

National Metal Molding Company, Pittsburgh, Pa., has just printed and is now distributing Bulletin 601, in which the complete line of National wall brackets is illustrated and fully described. Copy of this bulletin will be mailed promptly upon request of the manufacturer.

The Electric Controller & Manufacturing Company, Cleveland, Ohio, sends out a 24-page pamphlet, containing a paper by H. F. Stratton, presented May 26, 1917, at a meeting of the Association of Iron and Steel Electrical Engineers, at Chicago, on "An Automatic Starter for Induction Motors." This paper was reproduced in ELECTRICAL REVIEW of July 21, 1917, same being accompanied by illustrations.

Ingersoll-Rand Company, 11 Broadway, New York City, manufacturer of air compressors, rock drills, turbo blowing engines and pneumatic tools, announces that, at a meeting of the board of directors of the company, on July 25, 1917, J. H. Jowett, formerly general sales manager, was elected vice-president of the company, and that L. D. Albin, formerly assistant general sales manager, was appointed general sales manager. Mr. Jowett and Mr. Albin will continue to make the company's New York office their headquarters.

Marble-Card Electric Company of Gladstone, Mich., has been organized with a capital of $60,000.00 for the purpose of manufacturing direct-current commutating-pole motors and dynamos for all classes of service. The organization consists of F. H. Van Cleve, J. T. Jones, W. L. Marble and J. F. Card. The ground is now being broken for a modern one-story factory building 140 feet by 60 feet to be fully equipped with the best machinery for this class of manufacture. This concern will shortly be in the market for complete factory equipment including machine tools of all kinds and letters of inquiry should be addressed to J. F. Card.

Crouse-Hinds Company, Syracuse, N. Y., has issued Bulletin No. 303, dealing with Imperial floodlight projectors and Imperial reflectors. This bulletin replaces No. 302, which was issued only a few months ago. Since the earlier bulletin came out the demand for Crouse-Hinds projectors has been so marked as to call for the development of still further types. In addition to those projectors formerly listed the new bulletin shows projectors for use with 1000-watt lamps and arranged for both marine and land use. The new bulletin also contains much useful data on floodlight illumination and useful hints for the application of projectors for this purpose. Several good halftone illustrations are shown of the application of Crouse-Hinds projectors for the produc the application of Crouse-Hinds projectors for the protec and illustrated are intended for use chiefly in round houses, steel mills, prison corridors and construction work, where a stationary, strong and both gas and moisture-proof illuminating unit is desired. Copies of this new bulletin will be mailed free upon request to the company.

The Electric Storage Battery Company, with principal offices and works at Philadelphia, and having branches in all the other larger cities, has issued Bulletin No. 166, giving maps of cities, showing central-station locations, in which storage-battery installations have been made for stand-by service. As an example, in the city of Chicago twenty-three stand-by batteries, of an aggregate capacity of 95,210 amperes for one hour at 250 volts, are indicated by circles on the map; these installations are all in Commonwealth Edison Company's substations. On the same map seven exciter batteries have their locations indicated by crosses. In like manner, for instance, stand-by batteries in the central stations of Puget Sound Traction, Light & Power Company are indicated on the map of Seattle. Maps of all the larger cities give similar information. A general map of the United States and Canada is also given, whereby the number and locations of this company's batteries at central stations in the several states are shown. An illustration of a typical stand-by battery installation is shown to good advantage.

The Texas Company, 17 Battery Place, New York City, with branch offices at Chicago and Houston, Texas, issues a house organ called "Lubrication." The July number contains some useful facts. This company calls attention to its filtered lubricant for turbines, known as "Texaco Cetus" oil, said to separate readily from water, and not to emulsify, nor cause corrosion.

Storage Batteries for Wireless Service are now recognized as essential on ships as a means of sending out calls for help at sea. That is, it is important to have sources of electric current, other than that of the ship's dynamo, as the latter may be wrecked by the force or accident that makes an S O S call necessary. A storage battery, capable of long-distance calls by wireless, has been put on the market by The Electric Storage Battery Company, Philadelphia, especially designed for this class of service. It is known as the "Exide" battery, and has been installed on a number of ships. It is capable of operating wireless equipment, in an emergency, for four hours. This type of battery, together with standard type of switchboard panel for wireless service, is illustrated and described in The Electric Storage Battery Company's Bulletin No. 168.

Edison Storage Battery Company's Bulletin No. 600 is a book of pictures, with printed matter, telling an interesting story of storage-battery applications in industrial transportation. It takes up industrial electric tractors adapted to hard usage. These, of course, are made of different patterns, of different battery capacities, for adaptation to various uses. The illustrations show tractors in use for iron and steel haulage, for bulky goods, and lighter material in which rapidity of movement is required. The haulage of milk in cans, and other perishable products, are shown at freight terminals and delivery centers. A storage-battery tractor pulling 10 or 12 loaded trailers gives an idea of its capacity for work. They are much used at docks in transferring goods from ships to warehouse; also, in handling lumber at the big saw-mills. The book contains an illustration of the Edison cell, with steel container cut away to show its construction.

Demand for Soot Blowers Increasing.—According to the Diamond Power Specialty Company, Detroit, Mich., the increasing sale of mechanical soot blowers to central stations indicates a trend toward more attention to the boiler equipment which means of course greater all-around plant efficiency and greater economy. The trouble in the past has been that the engineer, superintendent or whoever assumes responsibility for boiler-room costs has started at the wrong end or in the middle to build up plant efficiency and cut operating costs. The logical place to start for greater plant efficiency and economy is at the coal-pile. Mechanical soot blowers keep boiler tubes absolutely free from soot and dirt and allow the maximum supply of heat to be absorbed by the water instead of passing out of the stack. Thus more water is evaporated with a given amount of coal than if the boiler tubes are covered with heat-resisting soot. Mechanical soot blowers are now thoroughly standardized. Babcock & Wilcox Company offer the Diamond soot blowers with every boiler they sell. And every boiler maker of any importance readily recommends the use of this equipment. He knows that the usefulness of the old-fashioned hand hose which he furnishes with his boilers is completely overshadowed by the general all-around superiority of the mechanical soot-blower system. Central stations which regard steam as money to a far greater degree than the average manufacturer have been quick to recognize the fuel-saving, labor-saving and boiler-efficiency-building advantages of the mechanical soot blower. During the month of June over 110,600 horsepower of central-station boilers were equipped with Diamond mechanical soot blowers. Some of the better known users of Diamond blowers in the electrical field are the General Electric Company, Detroit Edison, Brooklyn Edison, Edison Electric of Boston, Cleveland Municipal Plant, Nashville Ry. & Light Company, Erie Lighting Company, United Gas & Electric, Northern Ohio Traction and Light Company, Trunbull Public Service, Housatonic Power Company, Rochester Railway & Light Company, American Lighting Company.

Personal and Biographical

F. Von Schlegell, recently elected president and general manager of the Industrial Electric Furnace Company, is a native of St. Louis, Mo., and graduated in electrical engineering at the University of Minnesota, twenty years ago. For a year or two following

F. Von Schlegell.

graduation he engaged in hydroelectric development work, with the St. Anthony Falls Power Company, Minnesota. Then, entering the engineering department of the Great Northern Railway Company, he held various positions, including that of engineer on bridge construction, assistant division engineer at Great Falls, Mont., superintendent of shops at St. Cloud, Minn., and assistant division superintendent at Melrose and Breckinridge, Minn. Mr. Von Schlegell then left railroad work to become general superintendent of the works of Minneapolis Steel & Machinery Company, remaining in that position about two years. His next move was to accept the position of sales engineer for Fairbanks, Morse & Company, Chicago, spending four years in that work. At the end of that time he became sales engineer for Allis-Chalmers Company, Chicago, and after two years was made district manager, continuing in that capacity up to this date. Throughout this active career his numerous positions have brought him into the fields of civil, mechanical and electrical engineering, and his duties in a number of the positions named have been largely of an executive character. The last 12 years have brought him into contact especially with the railway, iron and steel industries. Mr. Von Schlegell's connections with the Industrial Electric Furnace Company came as the result of his being a member of the creditors' committee of the Snyder Electric Furnace Company.

P. B. Rice has resigned as electrical engineer of the United Gas & Electric Engineering Corporation, of New York City, to become mechanical and electrical engineer of the International Railway Company, of Buffalo, N. Y.

Harry E. Rennie has been appointed general manager for the Imperial Belting Company, Chicago; and W. S. Bloomer has been made general sales manager. Mr. Rennie formerly was western manager for this company.

J. B. Shickel has been made superintendent and electrical engineer for the Menominee & Marinette Light & Traction Company, Menominee, Mich., succeeding J. C. Sprong. Mr. Shickel, who is a graduate of Rose Polytechnic Institute, Terre Haute, Ind., was with the General Electric Company previous to the time of his recent appointment.

Charles W. Forbrich, who resigned from the Electrical Review Publishing Company just prior to its consolidation with the International Trade Press, Inc., has rejoined the staff of the Electrical Review in a more important capacity. Mr. Forbrich has been identified with the publishing business since 1888 and is widely known in electrical circles throughout the West and Middle West. In his new positon he will not be confined to advertising work, or to any particular territory, but will act as a general representative of the company and its affiliated interests.

George W. Steenbergh, formerly assistant treasurer of the Electrical Review and Western Electrician, has resigned to accept a position as special representative in the metal-cutting saw department of E. C. Atkins & Company, of Indianapolis, Ind. Mr. Steenbergh has been a member of the staff of the Electrical Review for the past ten years and recently has been in charge of the Cleveland office. While regretting his loss, his former associates join with his many friends in wishing him success in his new undertaking.

G. W. Steenbergh.

OBITUARY.

K. Birkeland, of Christiania, Norway, died in Tokyo on June 18. He was professor of physics at the University of Christiania, several years following 1898, and was a contributor of numerous papers on electric waves, cathode rays and atmospheric electricity. His most noteworthy achievement was, in association with Dr. S. Eyde, the working out of a practical method of producing nitrates from the air, which led to the development of this process on a large scale in Norway in 1908. This is known as the Birkeland-Eyde process.

B. H. Durbin, one of the best known and most popular of the younger electrical men in the Middle West, was killed in an automobile accident near Pittsburgh on July 21. Due to a faulty steering gear, the machine in which his party was driving to the country club, went over an embankment, killing Mr. Durbin instantly and severely injuring the other occupants of the car. For the past five years Mr. Durbin has been connected with the Bryan-Marsh Division, National Lamp Work of the General Electric Company, traveling out of its Kansas City office. He was an active Jovian, holding the office of statesman from Iowa. We are sure his many friends throughout Colorado, Nebraska and Iowa will feel the loss keenly as in his work he was a true disciple of good cheer and fellowship.

James Fulton Cummings, an electrical engineer with an international reputation, died on July 26, at Nassau Hotel, Long Beach, N. Y. Death was due to a stroke of apoplexy received while surf bathing.

Mr. Cummings was identified with the old Edison Company of New York, coming to the United States from Toronto, Canada, late in the eighties. He was forty-eight years old. He was widely known as an underground conduit engineer, and from 1892 to 1900 took out many important patents on underground conduits for electrical wires. For some fifteen years Mr. Cummings was the European agent at London for several important manufacturers of essentials for underground conduit work and made many large installations in England, Italy and Petrograd, Russia. After the successful construction of the conduit system in Russia, he went to England and remained there for a number of years representing the American Vitrified Conduit Company, the National Fire Proofing Co., and the American Circular Loom Co. He was a magnetic, popular and interesting personality, and was an authority in his line. Of splendid physique and athletic development he always retained his fondness for athletics. During his stay in London, for a number of years he was very popular, well known among the American Colony and was always ready to do what he could and to be of friendly service to the Americans who went over there. During his stay in London he was a member of the National Sporting Club of London and here in America he was a member of the New York Athletic Club. It was characteristic of Mr. Cummings that he was a friend of all Americans, no matter how forlorn, who ever called on him for aid while abroad.

Current Electrical News

WEEKLY RECORD OF CONSTRUCTION ACTIVITIES

EASTERN STATES.

PITTSFIELD, MASS.—The Barrett Company will build an extension to its local power plant. Headquarters of the company are at 35 Wendell Street, Boston.

NEW HAVEN, CONN.—Yale University has awarded a contract to the G. A. Dodge Company, Erie Street, Cambridge, Mass., for the erection of a new central power station.

BROOKLYN, N. Y.—The Edison Electric Illuminating Company, 360 Pearl Street, will make extensions and improvements in its power plant on Sixty-sixth Street, to cost about $15,000.

BUFFALO, N. Y. — Buffalo General Electric Company's recently authorized issue of $4,000,000 in bonds will be used to raise funds to extend power lines and the construction of an additional steam-electric plant outside of Buffalo.

ELLISBURG, N. Y.—Harlow E. Ralph has made application to the Public Service Commission for permission to build a new transmission line at Henderson and Ellisburg.

NEW YORK, N. Y.—The New York Telephone Company has filed notice at Albany of increase in its capital from $150,000,000 to $200,000,000.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has increased its capital from $9,500,000 to $10,250,000.

WASHINGTON, N. Y.—The Seneca River Power Company is planning for the construction of a new transmission line at Van Buren. Application for permission has been made to the Public Service Commission.

CHELSEA, N. J.—Contract for a power and heating plant in the new hotel to be erected by John Stafford has been awarded to Lewis Wanner, Inc., Philadelphia, Pa., at $185,000.

GLOUCESTER CITY, N. J.—The City Council has awarded a five-year street-lighting contract to the Public Service Electric Company, providing for the installation of two hundred and twenty-two new lamps as follows: One hundred and nine Type C, 600-candlepower lamps, $80 per year each; forty incandescent 100-candlepower lamps, $31.18 per year each, and seventy-three incandescent 32-candlepower lamps, $19 per year each. Heretofore one hundred and eighty-four street lights have been in use at an annual cost of $10,914.15.

KEYPORT, N. J.—The Borough Council is considering the installation of a new fire alarm system.

NEWARK, N. J.—The Jennings Fixture Company has submitted a low bid to the Common Council for the installation of a new lighting system in Center Market.

NEWARK, N. J.—The Board of Freeholders has awarded a contract to William G. Sharwell, 377 North Fifth Street, for the construction of an addition to the power plant at the Essex County Penitentiary, Caldwell, at a cost of $75,000.

NEWARK, N. J.—One of the 25,000 kilowatt turbo-generator units at the Essex power station of the Public Service Electric Company broke down on July 24, while under light load period, necessitating the cutting of the unit from the system. The generator will be repaired at once, requiring, it is said, three weeks or longer to place in running order.

PRINCETON, N. J.—The Public Service Electric Company has commenced the installation of an underground conduit system for street-lighting on Stockton Street.

HARRISBURG, PA.—The Bell Telephone Company of Pennsylvania is planning for the construction of a new aerial line to Paxtang. With other proposed extensions, the work is estimated to cost $13,000. The company will install a new switchboard and make other improvements at the plant of the Central Iron & Steel Company. W. H. Fetter is local manager.

HARWOOD, PA.—The Harwood Coal Company is installing a new electrically-operated steam shovel at its local culm banks, the first to be placed in service in this district. Power is furnished from the plant of the Harwood Electric Company. It is expected that similar shovels will be installed by other companies in the territory.

MARCUS HOOK, PA.—The Benzol Products Company will build a new one-story transformer and switch house, 30x36 feet, and about 17x23 feet, respectively, to cost $10,000. Contract for building construction has been awarded.

MARIETTA, PA.—The York Haven Power Company has commenced the construction of a dam in the Susquehanna River, near the Three-Mile Island. The structure will be about 800 feet long, with thickness of 5 feet, and is estimated to cost $20,000. It will be used for increased water power.

PHILADELPHIA, PA.—St. Vincent's Home is having revised plans prepared for a new power station to be erected in connection with a proposed four-story home at Lansdowne Avenue and Garrettford Road.

PHILADELPHIA, PA.—The Pennsylvania Railroad will build a new one-story, concrete boiler plant, 30x50 feet, at Girard Point, to cost about $12,000.

READING, PA.—The Reading Transit & Light Company, Boyertown & Pottstown Railway Company, United Traction Company, Birdsboro Street Railway Company, Front & Fifth Street Railway Company and the Reading & Womelsdorf Electric Railway Company have called a meeting of stockholders on August 6 to vote on a merger plan of the different companies to provide greater development of the electric light and power and street railway service in Reading, Lebanon and vicinities. The companies are all controlled by the same financial interests. The proposed corporation will be known as the Reading Transit & Light Company.

WAYNESBORO, PA.—The Hagerstown & Frederick Railway Company, Hagerstown, Md., is said to have closed negotiations for the purchase of the Waynesboro Electric Light & Power Company, and the Chambersburg, Greencastle and Waynesboro Street Railway Company.

WILKES-BARRE, PA.—The Lehigh Valley Railroad is reported to be planning for early construction work on the electrification of its line from Penn Haven to Wilkes-Barre, and from Penn Haven Junction to Hazleton and Mahanoy City.

MOCKSVILLE, N. C.—The matter of issuing bonds to raise funds for building and equipping an electric light plant and water works is being considered by the City Council.

MARLINTON, W. VA.—The city authorities are planning for the acquisition of a municipal electric-lighting plant.

FLORENCE, S. C.—Caroline Central Electric Company is improving its plant at a cost of about $90,000. A transmission line is being extended to Marion, Timmonsville and Darlington, to supply current to those towns.

GREENVILLE, S. C.—Southern Power Company, of Charlotte, probably will build an electric power transmission line to the army cantonment, estimated to cost $30,000.

ATLANTA, GA.—The Georgia Railway & Power Company is to construct a road five miles from Atlanta to Camp Gordon.

AUGUSTA, GA.—A hydroelectric plant is to be built, it is reported, by R. J. Edenfield, of Augusta, and W. E. Moore & Company, Pittsburgh, who have secured a franchise from the city.

MIAMI, FLA.—The Miami Traction Company will begin construction of a line to Buena Vista. Address B. B. Tatum, president.

NORTH CENTRAL STATES.

SANDUSKY, O.—Geo. Feick & Company, architects, have prepared plans for a $35,000 building for the Sandusky Telephone Company.

GOSHEN, IND.—State Public Board has been asked to allow the municipal water and light plant to increase rates.

LA PORTE, IND.—The plant of La Porte Gas & Electric Company was wrecked by a storm July 23, cutting off city's supply of light.

CHICAGO, ILL.—Sealed bids for furnishing and delivering 8,000, more or less, type B. & C., incandescent lamps for a period of one year from date of contract, will be received at the office of the Commissioner of Lincoln Park, Clark and Center Streets, until August 8. Address John C. Cannon, superintendent and treasurer.

EVANSTON, ILL.—C. H. Hale & Company have opened an electrical shop at 1916 Central Street.

GRAND RAPIDS, MICH.—The Electric Service, Power & Equipment Company has been incorporated to manufacture motors and other electrical apparatus. President, Joseph Brown; vice-president and treasurer, W. G. Brummeler; secretary, E. R. McDuffy.

CHIPPEWA FALLS, WIS.—The Eighth District Independent Telephone Association was organized July 19, with E. I. Bates as president.

KEEWATIN, MINN.—Business men have plans for organizing a company and establishing a telephone system.

EDDYVILLE, IA.—The Albia Interurban Company has the contract to equip with electricity the coal mines owned by Rex Fuel Company.

LEON, IA.—The telephone exchange was recently purchased by Mr. Orton, of Princeton, Mo.

MANCHESTER, IA.—Committee of Commercial Club is conferring with City Council on advisability of issuing bonds and building a municipal lighting plant. Iowa Electric Company's contract for street lighting will expire soon.

MONDAMIN, IA.—Bonds amounting to $12,000 have been voted for a municipal light and power plant.

PELLA, IA.—Pella Leffler Short Line Railway Company, incorporated with capital of $440,000, is reported to be ready to begin road construction.

STATE CENTER, IA.—Iowa Railway & Light Company of Marshalltown will build a transmission line to this place.

WATERLOO, IA.—The Cedar Valley Electric Company has applied for permission to build an electric transmission line in Franklin County.

WILTON JUNCTION, IA.—The Yankee Hollow Telephone Company has been incorporated with a capital of $420,000. Robert Harder, president.

CLAY CENTER, KANS.—United Telephone Company will erect a two-story building and equip it for offices and telephone exchange. Switchboard and accessories will cost $13,500.

INDEPENDENCE, KANS.—The Kansas Gas & Electric Company, with electric plants in all the principal cities of southern Kansas, is building a feed line from Cherokee to Cherryvale. The company has contracted to furnish the power for the Western States cement plant in this city and for the Union Traction Company, which operates interurban car lines between this city and Parsons and Coffeyville, and street car lines in Independence and Coffeyville.

KANSAS CITY, KANS.—The municipal electric plant managers of Kansas City, Kans., recently refused to furnish current to the Union Pacific Railroad Company's Central Avenue station, because they said the wiring would amount to more than the profits. The Standard Electric Light Company asked for and was granted the right by the city of furnishing this current.

LARNED, KANS.—A corporation will be organized to build a transmission line between here and Garfield, to cost between $6,000 and $7,000.

LURAY, KANS.—At a recent election the issuance and sale of electric light bonds was authorized.

MADISON, KANS.—The cast iron base and concrete foundation for light plant engine were damaged recently. The cost of repairs is estimated at $3,000.

MILTONVILLE, KANS.—The city is planning to dispose of the municipal light plant to the Riverside Electric Light, Power & Gas Company.

PLEASANT VALLEY, KANS. — The Pleasant Valley Mutual Telephone Company has been incorporated with a capital of $5,000. J. M. Eggen and E. S. McIntosh.

RILEY, KANS.—The R. B. Feagan Electric Company has sold its interest in the Riley Electric Light Company to J. J. Weisendanger.

ROSSVILLE, KANS.—The R. B. Feagan Electric Construction Company, of Junction City, Kans., has sold the electric plant here to a Colorado syndicate.

CHAPPEL, NEB. — John Wertz will build a telephone and store building. Cost, $5,000.

OGALLALA, NEB. — $10,000 in bonds have been voted for an electric light system.

PENDER, NEB.—Matter of rebuilding municipal electric light plant is being considered. Proposed plant would cost $12,000.

JAMESTOWN, N. D.—The Western Electric Company's plant was destroyed by fire.

SOUTH CENTRAL STATES.

CHATTANOOGA, TENN.—Tennessee Paper Company purpose building a new mill at a cost of $150,000. The plan contemplates installing electrical equipment.

JASPER, ALA.—Alabama Power Company has been granted a 30-year franchise to operate in this city. The local electric plant has been purchased and it is proposed to extend a transmission line from its plant at Parrish to Jasper.

LITTLE ROCK, ARK.—Little Rock Railway & Electric Company has been awarded the contract to supply electric current to the Twelfth Division cantonment near this city.

DALLAS, TEX.—City Commission granted the Texas Electric Company the right to construct tracks and buildings for an interurban express station at Young, Market, Wood and Jefferson Streets.

VICTORIA, TEX.—The City Council will employ an engineer to design a municipal electric light and power plant, and distributing system. The proceeds of the issue of $40,000 bonds that was voted two years ago are available for this purpose.

WESTERN STATES.

MALTA, MONT.—George W. Kemper, who recently purchased the electric light plant from the city, has the material on the way for the installation of the new system.

REDSTONE, MONT.—The city contemplates the installation of a telephone exchange. Address John Schlag.

AJO, ARIZ.—The Ajo Improvement Club has petitioned the Board of Supervisors for a franchise to supply the townsite of Ajo with electric light, telephone, water, gas and sewer service for domestic and commercial use.

WILLIAMS, ARIZ.—Since the utilities plant was destroyed by fire the city has had difficulty in securing light. Bonds will be voted for light and water improvements.

BATTLE MOUNTAIN, NEV.—Nevada Valleys Power Company has acquired the local electric plant, and was lately given a franchise to operate in Lander County. The plan is to enlarge the plant so as to transmit current to Copper Canyon, Copper Basin and other points, to supply power for mines and mills. A transmission line may be extended south to Austin.

DATES AHEAD.

Association of Iron and Steel Electrical Engineers. Eleventh annual convention, Philadelphia, Pa., Bellevue-Stratford Hotel, September 10 to 14 Secretary, J. F. Kelly. National Tube Company, McKeesport, Pa.

Association of Railway Telegraph Superintendents. Annual convention. Hotel Raleigh, Washington, D. C., September 10 to 13. Secretary, W. L. Connelly, Gibson, Ind.

International Association of Municipal Electricians. Annual convention, Niagara Falls, N. Y., September 11 to 14. Secretary, Clarence R. George. Houston, Texas.

Northwest Section. National Electric Light Association. Annual convention, Spokane, Wash., September 12 to 15. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash.

American Electrochemical Society. Annual convention, Pittsburgh, Pa., October 3 to 6. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

National Electrical Contractors' Association of the United States. Annual convention, New Orleans, La., October 10 to 13. Secretary, H. C. Brown, Utica, N. Y.

HORNSILVER, NEV.—A modern cyanide plant is under construction on Great Western mine, under direction of M. R. Thurston, consulting engineer. Crusher, ball mill, tube mills, conveyors, pumps and other machinery will be operated by electric motors, power for which to be produced by a generator driven by a 200-horsepower semi-Diesel oil engine.

MURRAY, IDAHO.—Washington Water Power Company is extending a transmission line into the Murray district to supply power for dredging operations on North Fork. The power line will cross the property of Giant Ledge Mining Company and current is to be furnished to operate the 150-ton mill being built on the Giant Ledge.

AMERICAN LAKE, WASH.—Contract for furnishing 20,000 feet of cotton drop cords for electric light bulbs at the training camp was awarded to American Steel & Wire Company, Seattle, by the Hurley-Mason Company, contractors on the job. A contract for 16,000 feet was awarded to the Detroit Insulated Wire Company.

INDEX, WASH.—G. N. Miller, Burke building, Seattle, has completed surveys for construction of the proposed lighting system at this place, same to cost about $12,000. Work is to be started early in August.

PASCO, WASH.—The Pacific Power & Light Company is to construct a new central switching station for a 66,000-volt system which will be installed here. The cost will be about $100,000.

SEATTLE, WASH.—Date of opening bids for construction of the complete hydro-electric light and power plant for the city of Seattle has been extended to August 31, 1917.

SEDRO WOOLLEY, WASH. — Sealed bids will be received by the State Board of Control, Olympia, Wash., up to 10:30 a. m., Monday, August 13, for construction of a power house and stack at the Northern State Hospital, near here. The work to be considered under the contract is the furnishing and installation of a new water tube boiler with the necessary steam, water, smoke and other connections. A certified check payable to the secretary of the State Board of Control required.

SEDRO WOOLLEY, WASH.—George W. Lawton, architect, Alaska building, Seattle, is preparing plans for a new power house at the Northern Hospital for the Insane. The appropriation amounts to $35,750.

TACOMA, WN.—An ordinance has been introduced in the City Council for the purchasing of machinery for converting alternating to direct current for use in the municipal street car service.

TACOMA, WASH.—The Puget Sound Traction, Light & Power Company, Seattle, has the contract to supply light and power for the army cantonment at American Lake (Camp Lewis). It will do all outside wiring and furnish transformers and motors.

TACOMA, WASH.—R. E. Lee, of the General Electric Company, this city, has closed contract with the Government for furnishing 20,000 incandescent Mazda electric bulbs for lighting the barracks and cantonment buildings at American Lake (Camp Lewis).

ALBANY, ORE.—The proposition of issuing $250,000 in bonds for purchasing the light and power plant and the water system of the Oregon Power Company will be voted on at a special election in December or at the general election in November, 1918. The Oregon Power Company is in the hands of a receiver.

HALFWAY, ORE.—The City Council has granted the Idaho Power Company a franchise, ending April 1, 1967, to operate electric light and power lines in this place.

PENDLETON, ORE.—The City Council contemplate the installation of a new electric lighting system.

SALEM, ORE.—The Salem Electric Company has been awarded the contract for wiring the new Oregon Agricultural College library at Corvallis.

LIVINGSTON, CAL.—The Livingston Board of Trade is circulating a petition, asking the supervisors to call a special election to vote on the proposition to form a lighting district, to take in the two town sites.

LOS ANGELES, CAL.—An auxiliary power plant is to be installed in San Francisquito Canyon, to be ready for service in a few months. The contract for generator, transformer and equipment has been awarded to the Westinghouse Electric & Manufacturing Company for $31,735.

LOS ANGELES, CAL.—A petition has been filed with the Board of Supervisors for the establishment of a highway lighting district, to be known as the Stephenson Avenue and Laguna Lighting District.

MODESTO, CAL.—Litigation between the Modesto and Turlock irrigation district and the Yosemite Power Company has been settled, and the power company has been awarded 66 second feet of water of the Tuolumne River.

OAKLAND, CAL.—Sealed bids are being received for electrical supplies for this city for the remainder of the fiscal year.

PLEASANTON, CAL.—Chas. Sengstacken succeeds J. A. Hunt, a dealer in electrical supplies in this place.

SAN DIEGO, CAL.—A petition applying for the formation of a public highway lighting district of Normal Heights has been filed with the Board of Supervisors.

SAN FRANCISCO, CAL.—H. S. Hittle has been awarded the contract for furnishing trolley poles and electric work for Twin Peaks Tunnel for $10,179.

SAN FRANCISCO, CAL.—The California Railroad Commission has instituted an investigation into the rates, rules and practices of the Great Western Power Company, the Sierra & San Francisco Power Company, and the Pacific Gas & Electric Company, applying to the business of the Pacific Electric Metals Company.

SAN FRANCISCO, CAL.—Plant of Coast Counties Gas & Electric Company, at Big Creek, was destroyed by fire.

SAN LUIS OBISPO, CAL.—The city clerk is receiving bids for furnishing city with gas or electricity for lighting the streets and public buildings.

PROPOSALS

HYDROELECTRIC POWER PLANT.—Board of Public Works, Seattle, Wash., which issued specifications for a hydro-electric plant of 25,000 kilowatts capacity, and asked for bids on same until July 20, extended date to Aug. 3, and since then has made another extension to Aug. 31. Bidders are asked to submit plans and unit prices on completed plant, including dam, pipe-line, penstocks, generating units, transformers and transmission lines to the city. Specifications will be furnished on application to J. D. Ross, Superintendent of Lighting, Seattle.

ELECTRICAL MATERIAL.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids on the following: Flexible brush-holder cable, and s. c. ignition cable, various delivery, under schedule 1376; 7,000 feet of 3 and 4 interior communication cable, delivery at Boston navy yard, schedule 1376; rubber insulated, intercommunication cable, various delivery, schedule 1376; 500 feet armored, searchlight controller cable, delivery at Boston navy yard, schedule 1376; armored and leaded telephone cable, various delivery, schedule 1376; twisted pair telephone cable, delivery at Boston navy yard, schedule 1374; d. c. shiplighting cable, 70,000 feet, delivery at Portsmouth and Boston navy yards, schedule 1374; silk-covered bell cord, various delivery, schedule 1376; fire-control telephone cord, 220,000 feet, various delivery, schedule 1376; incandescent lamp cord, various delivery, schedule 1374; 200 pounds annunciator wire, delivery at Mare Island, Cal., schedule 1374; insulated antenna wire, 130,000 feet, various delivery, schedule 1375; plain bell wire, 472,000 feet, various delivery, schedule 1376; solid fixture wire, 5,000 feet, delivery at Charleston, S. C., navy yard, schedule 1374; single, rubber-insulated, lighting and power wire, various delivery, schedule 1374; plain, lead and armored, twin conductor, flexible, lighting and power wire, also cotton and silk covered, flat, magnet wire, various delivery, schedule 1376; rubber insulated pothead wire, 6,000 feet, delivery at Norfolk, Va., navy yard, schedule 1374; rubber-insulated telephone wire, delivery at Boston and Charleston navy yards, schedule 1374.

MACHINES AND MACHINE TOOLS—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids on the following machines and tools: Five 12-inch, geared head, motor-driven lathes; one electrically-driven planing machine; two motor-driven, vertical milling machines; one motor-driven, 3-spindle drill press; two electrically-driven, vertical, 6½-inch sharpeners; all above, under Schedule 1378, for delivery at South Charleston, W. Va., Navy Yards; one 24-inch planer, bevel gear, motor-driven, under Schedule 1377, for delivery at Philadelphia Navy Yard.

ELECTRICAL EQUIPMENT—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids on the following, under Schedule No. 1367: Annunciators, type B, water tight; water and non-water-tight vibrating bells; pear push buttons; portable salvo-firing buzzers; 4,000 rubber ear cushions; 136 magneto, testing generators; 325 fire-control, telephone jacks; 800 non-water-tight telephone plugs; 120 portable telephone testing plugs; portable ventilating sets; 550 fire-control telephones; service ships' telephones. The 325 fire-control telephone jacks are for delivery at Portsmouth, N. H., Navy Yard; all other material named for various delivery.

ELECTRIC CABLE—General Purchasing Officer for Panama Canal, Washington, D. C., will receive bids until Aug. 6 for an electric cable, with vitrified and tile ducts.

INCORPORATIONS

NORTHPORT, WASH.—The Northport Power & Light Company has filed articles of incorporation with a capital of $200,000. Lorne A. Campbell and others are the incorporators.

OGDEN, UTAH.—The Buckle Electric Company has been incorporated by J. V. Buckle, M. M. Allison, Mary E. Freck, Gladys Buckle and J. G. Larison.

RICHLAND, CAL.—The Eagle Telephone Company has been incorporated with a capital stock of $1,560.

TOWER, WN.—The Farmers' Mutual Telephone Company has been incorporated in this place.

ALTON, ILL.—The Alton & Edwardsville Railway Company has been incorporated with a capital of $6,000. Louis A. Schafly is one of the incorporators.

MADISON, WIS.—Articles of incorporation were filed in the office of the secretary of state on Tuesday as follows: The Wasson Trolley & Manufacturing Company, Milwaukee. Capital, $50,000. To make and sell trolley bases and other railway equipment.

PALMYRA, ILL.—Palmyra Light, Heat & Power Company, Palmyra. Capital, $10,000. Incorporators: Lewis M. King, Clarence W. King and Nellie G. King.

SEATTLE, WASH.—Automatic Electric Controller Company, Seattle. Capital, $250,000. Incorporators: J. C. Arnold, M. C. Livinson, E. C. Kilbourne, H. McMullen, R. W. A. Simmons.

JAMESTOWN, N. D.—Jamestown Light & Power Company, with capital stock of $450,000, was incorporated by O. J. Johnson, Clarence Alm and Ormsby McHarg.

DAYTON, O.—The Gilbert-Baker-Midlam Company, Dayton. Capital, $8,000. Electro plates. Incorporators: W. A. Gilbert, Charles A. Baker, Wilbur E. Midiam, Jr., Wm. L. Blocher and David P. Hoffman.

NEW PUBLICATIONS

CHARACTERISTICS OF TALC—The U. S. Geological Survey's bulletin on Talc and Soapstone describes talc in the following language: "Chemically, talc is an acid metasilicate of magnesium, remarkable for its softness, soapy feel, difficult fusibility, insolubility in ordinary acids, and low electric conductivity. These properties make it one of the most stable and unchangeable of minerals, and therefore one of the best means of protection against changes in temperature or other conditions. On this account talc is one of the most useful minerals."

ALCOHOL AS SOURCE OF POWER—Department of Chemistry, South Australia, has issued Bulletin No. 8, containing an article on the use of alcohol in the production of power, by W. T. Rowe. Results of tests are given. A conclusion is that alcohol, with suitably constructed engines, gives more power than petrol.

FINANCIAL NOTES

W. S. Barstow & Company, engineers and managers of utilities in various parts of the country, in their weekly News Letter of July 25, comment as follows:

"There are recognized essentials to the success of all public service enterprises, whether they be railroad, telegraph, telephone, electric light or power. The services furnished by such companies, unlike commodities classed as 'industrials,' must keep up with the growth of public demand, intensified by increase in population. This makes it absolutely necessary that capital be commanded at all times, and capital can only be commanded when it is assured of the highest return on the best security, in competition with all classes of investments. If capital is not ready at the time when needed to supply these demands of the public, the demands cannot be complied with, and as they cannot be postponed, the undertaking eventually fails as surely as it would fail if its operations ceased. The investor has and probably always will (unless his actions also are regulated through Commission control) contribute his capital to the industry promising him the best security, with the best return, and he will select his own time for so doing, depending upon general conditions as he sees them.

"Commissions, as a rule, do not generally appreciate that the ability of a company to raise capital, not only economically, but often at all, depends as much upon the condition of the general financial market at the time as upon the character of the securities which they authorize. There are many cases where the credit of companies has been seriously impaired through losses of favorable opportunities to sell securities, and which was due to delays in securing prompt decisions from commissions.

"Incomplete regulations, as they now exist in many cases, produce results

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. rate per cent.	Bid July 24.	Bid July 31.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	..	18	18
Adirondack Electric Power of Glens Falls, preferred	6	72	72
American Gas & Electric of New York, common	10+extra	111	111
American Gas & Electric of New York, preferred	6	47½	47½
American Light & Traction of New York, common	..	308	300
American Light & Traction of New York, preferred	6	108	108
American Fower & Light of New York, common	4	67	67
American Power & Light of New York, preferred	6	86½	89½
American Public Utilities of Grand Rapids, common	..	28	28
American Public Utilities of Grand Rapids, preferred	6	64	64
American Telephone & Telegraph of New York	..	120⅞	119
American Water Works & Elec. of New York, common	..	7¾	7½
American Water Works & Elec. of New York, particip.	7	23	22
American Water Works & Elec. of New York, first preferred	..	69	67
Appalachian Power of Bluefield, common	..	4½	4
Appalachian Power of Bluefield, preferred	7	30	30
Cities Service of New York, common	6+extra	274	274
Cities Service of New York, preferred	6	85	86¼
Commonwealth Edison of Chicago	8	121½	120½
Comm. Power, Railway & Light of Jackson, common	4	48	48
Comm. Power, Railway & Light of Jackson, preferred	6	76	76
Federal Light & Traction of New York, common	..	12	12
Federal Light & Traction of New York, preferred	..	44	47
Illinois Northern Utilities of Dixon	6	78	78
Middle West Utilities of Chicago, common	2+2 extra	42	39
Middle West Utilities of Chicago, preferred	6	70	71
Northern States Power of Chicago, common	7	89	89
Northern States Power of Chicago, preferred	7	96½	96½
Pacific Gas & Electric of San Francisco, common	5	54½	54
Pacific Gas & Electric of San Francisco, preferred	6	89	89½
Public Service of Northern Illinois, Chicago, common	7	92½	92
Public Service of Northern Illinois, Chicago, preferred	6	97	97
Republic Railway & Light of Youngstown, common	4	32¾	33
Republic Railway & Light of Youngstown, preferred	6	64	66
Standard Gas & Electric of Chicago, common	..	9½	10
Standard Gas & Electric of Chicago, preferred	6	35	35¼
Tennessee Railway, Light & Power of Chattanooga, common	..	5¾	5⅞
Tennessee Railway, Light & Power of Chattanooga, preferred	6	29	30
United Light & Railways of Grand Rapids, common	4	40	40
United Light & Railways of Grand Rapids, preferred	6	68	69
Western Power of San Francisco, common	..	13½	13½
Western Power of San Francisco, preferred	6	54	54
Western Union Telegraph of New York	extra	93¾	92¾
Industrials—			
Electric Storage Battery of Philadelphia, common	4	60½	59½
General Electric of Schenectady	8	154½	154
National Carbon of Cleveland, common	8	79¾	79
National Carbon of Cleveland, preferred	..	Last sale	130¾
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	48¾	48½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	65	65

similar to the case in a surgeon's report: 'The operation was an unqualified success, but, unfortunately, the patient died.' The success of regulation can best be realized in the long and healthy life of the patient."

Nearly one million tons of coal represents the amount of fuel which will be saved to the country by Byllesby electric properties during 1917, because of the great extent to which their electrical requirements are supplied by water power or are generated with natural gas fuel. This means that the amount of electricity generated during the year by Byllesby properties by water power or natural gas would require one million tons of steam coal if generated in coal-fired steam stations. One million tons of steam coal represents nearly $4,000,000 at present prices. The natural gas fuel used is purchased by the companies under long-term contracts at low prices.

Reports of Earnings.

NORTHERN STATES POWER COMPANY.

Northern States Power Company for the month of June shows an increase of 20.7 per cent in gross earnings over June, 1916. The gain in net earnings is 16.5 per cent. Comparative figures for the month and year ended June 30 are as follows:

Month of June.	1917.	1916.
Gross earnings .....$	527,755	$ 436,913
Net earnings	276,634	237,447
Year ended June 30.		
Gross earnings	6,599,517	5,613,608
Net earnings	3,498,558	3,132,177

WESTERN STATES GAS & ELECTRIC COMPANY.

Gross earnings of the Western States Gas & Electric Company for the month of June show an increase of 13.8 per cent over June, 1916. Comparative figures for the month and the year ended June 30 are given below:

Month of June.	1917.	1916.
Gross earnings .....$	115,149	$ 101,165
Net earnings	54,983	52,397
Year ended June 30.		
Gross earnings	1,309,208	1,215,870
Net earnings	622,771	585,502

Stockholders of the Buffalo General Electric Company, Buffalo, N. Y., voted to authorize an issue of $4,000,000 6% twelve-year bonds, convertible into stock of the company. The funds raised will be used to finance extensions, including additional construction of the steam power generating plant outside of Buffalo.

DETROIT UNITED DIVIDEND.

The board of directors of the Detroit United Railway Company have declared a dividend of $2 per share, being at the rate of 8% per annum, payable Sept. 1 to stock of record Aug. 16 at 3 p. m.

Electrical Patents Issued July 17, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,233,296. High-Tension Insulator. A. O. Austin, assignor to Ohio Brass Co., Mansfield, Ohio. Suspension type.

1,233,304. Electric Apparatus. A. Benko, New York, N. Y. Therapeutic appliance.

1,233,305. Electromagnetic Musical Instrument. G. Breed, assignor to Lyrachord Co., New York, N. Y. Mechanism for operating strings by electromagnets.

1,233,328. Operating Means for Reciprocatory Elements. P. J. Dreher, Toledo, Ohio. Switches and gearing of motor for operating pneumatics of musical instruments.

1,233,329. Electric Locomotive. G. M. Eaton, assignor to Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. Mounting and gearing of motors.

1,233,339. Chain-Guide for Pull-Sockets. D. D. Gordon, assignor to The Yost Electric Mfg. Co., Toledo, Ohio. For attachment to side of lamp socket.

1,233,341. Electromagnetic Shift for Headlights. H. S. Gove, Moorhead, Miss. Turns the light-supporting bracket about its axis.

1,233,346. Control System. A. J. Hall, assignor to Westinghouse Electric & Mfg. Co. Motor control for single-phase railway system.

1,233,353. Dynamo-Electric Machine. R. E. Hellmund, assignor to Westinghouse Electric & Mfg. Co. Alternating-current motor of the commutator type.

1,233,354. Dynamo-Electric Machine. R. E. Hellmund, assignor to Westinghouse Electric & Mfg. Co. Control for reversing motors of above type.

1,233,355. Work-Support for Cutting-Machines. C. T. Henderson, assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis. Work is held in place on planers and the like by electromagnets.

1,233,363. Apparatus for Electrolytically Recovering Metals. G. A. James, assignor of one-half to J. H. Alling and one-half to F. M. Wright, San Francisco, Cal. Metalliferous pulp is acted on by series of electrolytic cells.

1,233,364. Electric Switch. O. Johnson, Chicago, Ill. Motor circuit breaker for an electrically propelled vehicle.

1,233,369. Ignition System. C. F. Kettering, assignor to The Dayton Engineering Laboratories Co. Gearing and mounting of timing and distributing mechanism.

1,233,370. Control for Electrical Systems. C. F. Kettering, assignor to The Dayton Engineering Laboratories Co. Resistance regulator.

1,233,378. Railway-Switch Throw. A. Loeffler, assignor to J. Foehrenbach, Jamaica, N. Y. Details of solenoid-operated gearing.

1,233,395. Electric Hot-Plate or Heat Unit. J. C. Patten, assignor to The Globe Stove & Range Co., Kokomo, Ind. Flattened heating coils are mounted in grooves in a porcelain plate and covered with a metal shield plate.

1,233,402. Control System. L. G. Riley, assignor to Westinghouse Electric & Mfg. Co. For railways having supply sources of different voltages.

1,233,411. Control System. K. A. Simmon and A. J. Hall, assignors to Westinghouse Electric & Mfg. Co. Modification of No. 1,233,346.

1,233,412. Control System. K. A. Simmon and A. J. Hall, assignors to Westinghouse Electric & Mfg. Co. Resistance control for three-phase motors.

1,233,415. Electrical Insulation. W. H. Steinberg, assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis. A cementitious binder including stearin pitch and a volatile solvent therefor.

1,233,416. Electrical Insulating Composition and Process of Making the Same. W. H. Steinberg, assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis. Includes comminuted asbestos and sulfur and a binder of coal tar pitch, stearin pitch and an oil capable of vulcanization or polymerization mixed with a volatile solvent.

1,233,434. Arc-Welding Apparatus. E. S. Zuck, assignor to Westinghouse Electric & Mfg. Co. Portable work support with specially adjustable carbon mounting.

1,233,443. Signaling Apparatus. H. G. Brown, assignor to McKenzie, Holland & Westinghouse Power Signal Co., London, England. Provision for selectively operating a plurality of indicators from a source.

1,233,473. Railway Signaling. S. C. Hofman, assignor to Union Switch & Signal Co., Swissvale, Pa. For single-track roads.

1,233,475. Insulator. C. C. Hudson, Niceville, Fla. Has a screw shank.

1,233,486. Electrical Insulator. F. M. Locke, Victor, N. Y. Consists of silica, boric acid, alumina, lithia and an alkali having a coefficient of expansion less than .0000056.

1,233,488. Railway Signaling. R. A. McCann, assignor to Union Switch & Signal Co. For single-track roads.

1,233,495. Light-Diffuser for Automobile Headlights. C. H. Muckenhirn, Detroit, Mich. Special film-like member on face of lens.

1,233,519. Telegraphy. G. O. Squier, Mayfair, London, England. Signals differentiated by varying the amplitude of an uninterrupted alternating current.

1,233,522. Sounding Apparatus. F. Stevens and G. F. Stevens, Philadelphia, Pa. Sinker has electric circuits controlled by water pressure.

1,233,531. Circuit-Controller. F. B. Wiegand, assignor to Union Switch & Signal Co. Railway traffic control apparatus.

1,233,566. Ethylene-Generator. W. K. Freeman, New York, N. Y. Comprises passing hydrogen through the hot carbon zone of an arc.

1,233,568. Bus-Bar Insulator and Support. F. E. Getts, assignor to Electrical Engineers Equipment Co., Chicago, Ill. Structural details. (See cut.)

1,233,569. Apparatus for Driving Machines. B. Graemiger, assignor to Aktiengesellschaft der Maschinenfabriken Escher, Wyss & Co., Zurich, Switzerland. Motor has gas-tight partition between rotor and stator.

1,233,580. Process of Extracting Copper from Oxidized Ores. N. V. Hybinette, Christiania, Norway. Includes electrolytic treatment.

1,233,584. Means for Transferring High-Potential Electric Currents as Arcs. C. G. Koppitz, Wilkinsburg, Pa. Switching mechanism with the air withdrawn adjacent the arcing contacts.

1,233,587. Method of Generating Ignition-Currents for Internal-Combustion Engines and Apparatus Therefor. G. L. Lang, assignor to Splitdorf Electrical Co., Newark, N. J. Magneto structure.

1,233,588. Electrical Switching Apparatus. F. B. Little, assignor by mesne assignments to J. C. Deagan Musical Bells, Chicago, Ill. Details of special structure.

1,233,597. Flush Switch. W. J. Newton, assignor to Newton Mfg. Co., Lynbrook, N. Y. Structure of device operated by oscillating key.

1,233,602. Plating Apparatus. G. T. Potthoff, Brooklyn, N. Y. Arrangement of electrodes and reversely rotatable container.

1,233,617. Street-Lantern. A. J. Sweet, Wauwatosa, Wis. Semi-indirect, pendant structure.

1,233,620. Telephone Call Registering Device. V. Thompson, Vancouver, British Columbia, Canada. Coin operated.

1,233,630. Spark-Plug. H. Z. White, Buffalo, N. Y. Structural details.

1,233,633. Process for Coating Metal. B. P. Allen, Great Neck Station, N. Y. Article is immersed in bath of water, lead chromate and acetic acid, and current passed.

1,233,640. Conjunction Member for Electric Fixtures. G. A. Boomer, assignor to The Plume & Atwood Mfg. Co., Waterbury, Conn. Sheet metal structure for mounting sockets.

1,233,646. Signal Device. D. J. Cook, assignor of one-fourth to A. L. Zwisler, one-fourth to M. Heath and one-fourth to E. Heath. Direction indicator for automobiles has electromagnetically signbearing slides and is electrically illuminated.

1,233,651. Electrical Signaling-Horn. W. W. Dean, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Has diaphragm operated by electromagnet.

1,233,671. Electrical System of Distribution and Regulating Apparatus Therefor. W. Jepson, New York, N. Y. Lights operated from variable-voltage source as in car lighting.

1,233,679. Electrical Signal-Transmitter. J. McFell, Chicago, Ill. Spring motor operated.

1,233,688. Electric Welding-Machine. T. E. Murray and H. R. Woodrow, New York, N. Y., said Woodrow assignor to said Murray. For welding gear teeth.

1,233,689 and 1,233,690. Process of and Apparatus for Electrically Making Holes in Metal Blocks or Plates. T. E. Murray, Jr., Brooklyn, N. Y. First patent: Plate is placed between a solid cylindrical electrode and another electrode having a hole registering with the first electrode, the metal being melted out by current between the electrodes. Second patent, modification.

1,233,691. Process of and Apparatus for Electrically Dividing Metal Plates or Blocks. T. E. Murray, Jr., New York, N. Y. Plate is secured to plate electrodes separated by the dividing line and the metal melted by the passage of current.

1,233,692. Time-Switch. H. C. Nicho-

laus, assignor to The Standard Electric Stove Co., Toledo, Ohio. Controlled by clock mechanism.

1,233,720. Fuse-Plug. S. T. Sjoberg, Minneapolis, Minn. Structure of multiple fuse plug.

1,233,738. Pulp-Feed Regulator. I. J. Witham, assignor of one-half to G. S. Witham, Sr., Hudson Falls, N. Y. Motor controlling feed valve is controlled according to the density of the pulp.

1,233,746. Thermostatic Circuit Breaker. N. Bendixen, Copenhagen, Denmark. Contacts are operated by a pair of expansible fluid receptacles.

1,233,755. Refrigerating Apparatus. E. P. Connelly, Boston, Mass. Flow of cooling medium is electrically controlled according to a gauge on the expansion side of the system.

1,233,764. Manufacture of Commutators. C. W. Dunham, assignor to Union Switch & Signal Co., Swissvale, Pa. Details of method of making.

1,233,766 and 1,233,767. Duplex Circuit. L. Espenschied, assignor to American Telephone & Telegraph Co, First patent, special inductance device in combination with two physical circuits consisting of line conductors, together furnishing a phantom circuit. Second patent, modification.

1,233,768. Inductance Device. L. Espenschied, assignor to American Telephone & Telegraph Co. Loading coil for use in duplex circuits as above.

1,233,769. Duplex Circuit. L. Espenschied, assignor to American Telephone & Telegraph Co. Modification of above duplex circuits.

1,233,774. Telegraph Key. M. N. Gwinn, Meadow Creek, W. Va. Structural details of Morse key.

1,233,804. Magnetic Separator. R. D. Pike, San Francisco, Cal. Detailed arrangement of electromagnets, ore conveying cylinder, etc.

1,233,807. Method of Making Insulated Wires. R. H. Read, assignor to General Electric Co. For making fireproof armored conductors for electric heaters.

1,233,808. Sheathed Heater-Wire and Method of Making Same. R. H. Read, assignor to General Electric Co. Wire covering of asbestos is impregnated with mineral insulation and encased in metal sheath.

1,233,819. Automatic Telephone-Exchange System. A. B. Sperry, assignor by mesne assignments to Western Electric Co. Signaling arrangements.

1,233,828. Hanger-Link for Suspending Light-Reflecting Bowls. E. L. White, assignor to J. H. White Mfg. Co., Brooklyn, N. Y. Structural details.

1,233,829. Socket Connection for Lighting-Fixtures. E. L. White, assignor to J. H. White Mfg. Co. Structural details.

1,233,830. Telephone-Exchange System. J. L. Wright, assignor to Western Electric Co. Semi-automatic.

1,233,831. Selector-Switch. A. H. Adams and A. E. Lundell, assignors to Western Electric Co. For telephone systems.

1,233,837. Telephone-Exchange System. J. D. Bonnar, assignor to J. R. Garfield, trustee, Cleveland, Ohio. Semi-automatic.

1,233,838. Electric Oven. J. Bradley, assignor to A. Westlake, New York, N. Y. Details of special structure.

1,233,841. Means for Receiving Electrical Oscillations. E. E. Butcher, assignor to Marconi Wireless Telegraph Co. of America. For receiving oscillations of a given relatively high frequency.

1,233,852. Liquid Rheostat. G. H. Dorgeloh, assignor to General Electric Co. Arrangement of tanks and variably immersible electrodes.

1,233,854. Motor-Control System. J. Eaton, assignor to General Electric Co. For a drive for planers and the like.

1,233,865. Engine Control. H. L. Gerken, New York, N. Y. Has interrelated spark and carburetor control.

1,233,870. Automatic Telephone System. C. L. Goodrum, assignor to Western Electric Co., Inc. Arrangement of finders and starter circuit.

1,233,877. Variable-Speed Controller. C. T. Henderson, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Has electromagnetically controled gearing and resistance control for motor.

1,233,882. Candle-Cup for Lighting-Fixtures. W. R. Kahns, assignor to J. H. White Mfg. Co., Brooklyn, N. Y. For mounting electric lights in imitation of candles.

1,233,883. Motor Arc-Lamp. C. Kramer, assignor to General Electric Co. Method of regulating the electrodes.

1,233,891. Automatic Telephone System. A. E. Lundell, assignor to Western Electric Co., Inc. Grouping of selector switches and trunks.

1,233,892. Semi-Automatic Telephone System. A. E. Lundell, assignor to Western Electric Co., Inc. Arrangement of "A" and "B" operators' positions.

1,233,893. Telephone-Exchange System. A. E. Lundell, assignor to Western Electric Co., Inc. Arrangement of connector and selector switches.

1,233,894. Telephone-Exchange System. A. E. Lundell, assignor to Western Electric Co., Inc. Arrangement of selectively operable switch and finders.

1,233,899. Dynamo-Electric Machine. A. H. Neuland, New York, N. Y. Alternating current, commutator machine.

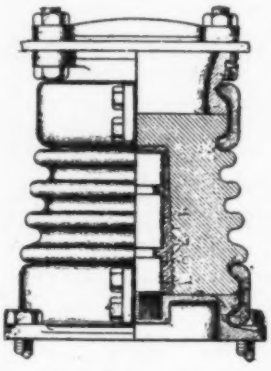
1,233,900. Alternating-Current Motor. A. H. Neuland, New York, N. Y. Modification of above.

1,233,906. Apparatus for Production of Copper by Electrolysis. M. Perreur-Lloyd, Boulogne-sur-Seine, France. Has a rotary cylindrical electrode within a casing constituting the other electrode.

1,233,925. Process of Manufacture of Aluminum Nitrid. O. Serpek, assignor to Société Generale des Nitures, Paris, France. Mixed powdered alumina and carbon are passed through arc in presence of previously heated nitrogen.

1,233,926. Process for the Manufacture of Aluminum Nitrid. O. Serpek, assignor to Société Generale des Nitures, Paris, France. Modification of above.

1,233,940. Telephone-Exchange System. H. G. Webster, assignor to J. R. Garfield, trustee, Cleveland, Ohio. Arrangement of "tens" and "units" relays for connecting lines with trunks.



No. 1,233,568.—Busbar Insulator and Support.

1,233,952. Automatic Control of Phase-Converters. E. F. W. Alexanderson, assignor to General Electric Co. For maintaining polyphase currents balanced in single phase to polyphase systems.

1,233,953. Regulator for Phase-Balancers. E. F. W. Alexanderson, assignor to General Electric Co. For balancing the voltages on a polyphase system having unbalanced load.

1,233,959. Motor-Controller. H. G. R. Bennett, Youngstown, Ohio. Liquid rheostat.

1,233,961. Engine-Starting Apparatus. J. Bijur, assignor to Bijur Motor Lighting Co., New York, N. Y. Connections of starting motor with engine controlled by current of generator driven by engine.

1,233,968. Electric Heater. C. F. Bradburn, Delmer, Ontario, Canada. Resistance coil has special arrangement of tubes for convection air currents.

1,233,989. Percussion Sounding Device. J. C. Deagan, Chicago, Ill. Has electromagnetically operated hammer for setting vibrator in operation.

1,234,028. Electric-Lighting Apparatus for Vehicles. W. H. Honsberger, assignor of one-fourth to G. C. Brown, Welland, Ontario, Canada. Arrangement of switches and circuits for controlling head and other lights.

1,234,060. Incandescent Electric Lamp. G. M. J. Mackay, assignor to General Electric Co. Nitrogen-filled tungsten lamp.

1,234,063. Rain-Signal. F. A. Meng and L. G. Schrader, Flint, Mich., said Meng assignor to said Schrader. Rain collected in cup closes alarm contact.

1,234,069. Electric Switch. A. H. Nero, assignor to the Arrow Electric Co., Hartford, Conn. Two-push button.

1,234,099. Rectifying System for High-Tension Alternating Currents. J. H. Lendi, Chicago, Ill. Structure of high-tension commutator.

1,234,100. Renewable Inclosed Fuse. W. J. Morgan, St. Louis, Mo. Structural details.

Patents Expired.

The following United States electrical patents expired on July 31, 1917:

654,583. Machine for Winding and Insulating Electric Coils. J. C. Anderson, Jersey City, N. J.

654,586. Conduit Electric-railway System. F. M. Ashley, New York City.

654,595. Method of Operating Dynamo-electric Machines. E. J. Berg, Schenectady, N. Y.

654,625. Signaling Device. J. L. Hall, Schenectady, N. Y.

654,630. Radiophony. H. V. Hayes and E. R. Cram, Cambridge, Mass.

654,631. High or Low-water Alarm for Boilers. E. D. Hayes, Philadelphia, Pa.

654,632. Gear for Motor Cars. J. J. Heilmann, Paris, France.

654,656. Elevator Controller. N. O. Lindstrom and A. Corperthwait, New York City.

654,658. Electric Railway. G. A. Lyncker, Munich, Germany.

654,663. Electric Regulating Device. W. S. Moody, Schenectady, N. Y.

654,679. Electric Arc Lamp. C. Schuster, Pittsburgh, Pa.

654,693. Electrical Igniter for Hydrocarbon Engines. H. Wegelin, Augsburg, Germany.

654,700. Electric Controller. W. Asbury, New York, N. Y.

654,734. Electric Commutator Cleaner. A. H. Jahn, Homestead, Pa.

654,747. Supervisory Signal for Telephone Switchboards. F. R. McBerty, Downers Grove, Ill.

654,748. Telephone Toll Apparatus. F. R. McBerty.

654,749. Signal Appliance for Telephone Switchboards. F. R. McBerty.

654,750. Switchboard for Telephone Lines. F. R. McBerty.

654,752. Speed-governor Attachment for Electrical Apparatus. J. H. McGurty, Jersey City, N. J.

654,758. Apparatus for Telephone Switchboards. J. J. O'Connell, Chicago, Ill.

654,803. Trolley Wheel. S. G. Reynolds, Easton, Pa.

654,816. Electrical Transmission of Power. I. E. Storey, Trenton, N. J.

654,818. Sparking Igniter for Explosive Engines. H. C. Thamsen, Hamburg, Pa.

654,821. Flashlight System. M. Wright, San Antonio, Tex.

654,847. Automatic Circuit-breaker. W. M. Scott, Philadelphia, Pa.

654,848. Automatic Magnetic Circuit-breaker. W. M. Scott, Philadelphia, Pa.

654,851. Semaphore-operating Mechanism. J. Shoecraft, Eskridge, Kans.

654,871. Electric Cable. J. Y. Buchanan, Edinburgh, Scotland.

654,883. Motor Controller. W. B. Elliott and J. W. Eskholme, Westfield, N. J.

654,924. Switchboard for Telephone Lines. C. E. Scribner, Chicago, Ill.

654,951. Process of Manufacturing Composition Applicable for Electric Insulation. W. J. Cordner, London, England.

654,952. Composite Material Applicable for Electric Insulation. W. J. Cordner.

654,967. Electric Signal and Fire Alarm. D. Geywits, Rome, and W. Still, Utica, N. Y.

654,999. Electric Motor. W. S. Moody, Schenectady, N. Y.

655,006. Electric Lock. T. P. Pratt, Boston, Mass.

655,014. Trolley. F. J. Rogers, Crafton, Pa.

655,032. Rectifying Alternating Currents. E. Thomson, Swampscott, Mass.